FIG. 1

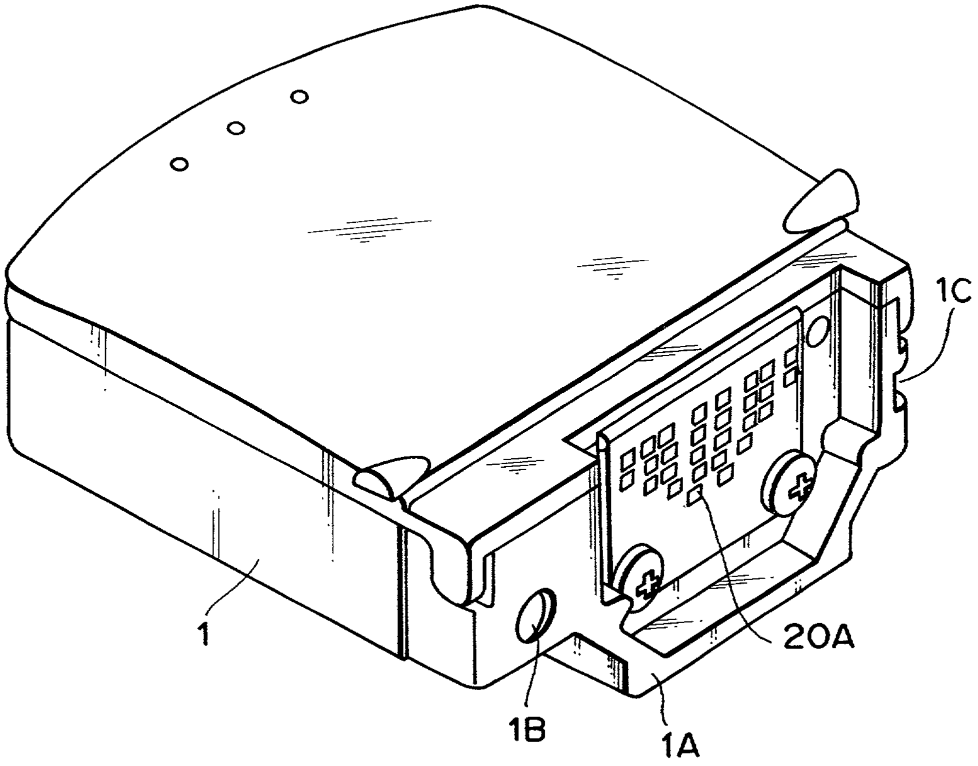
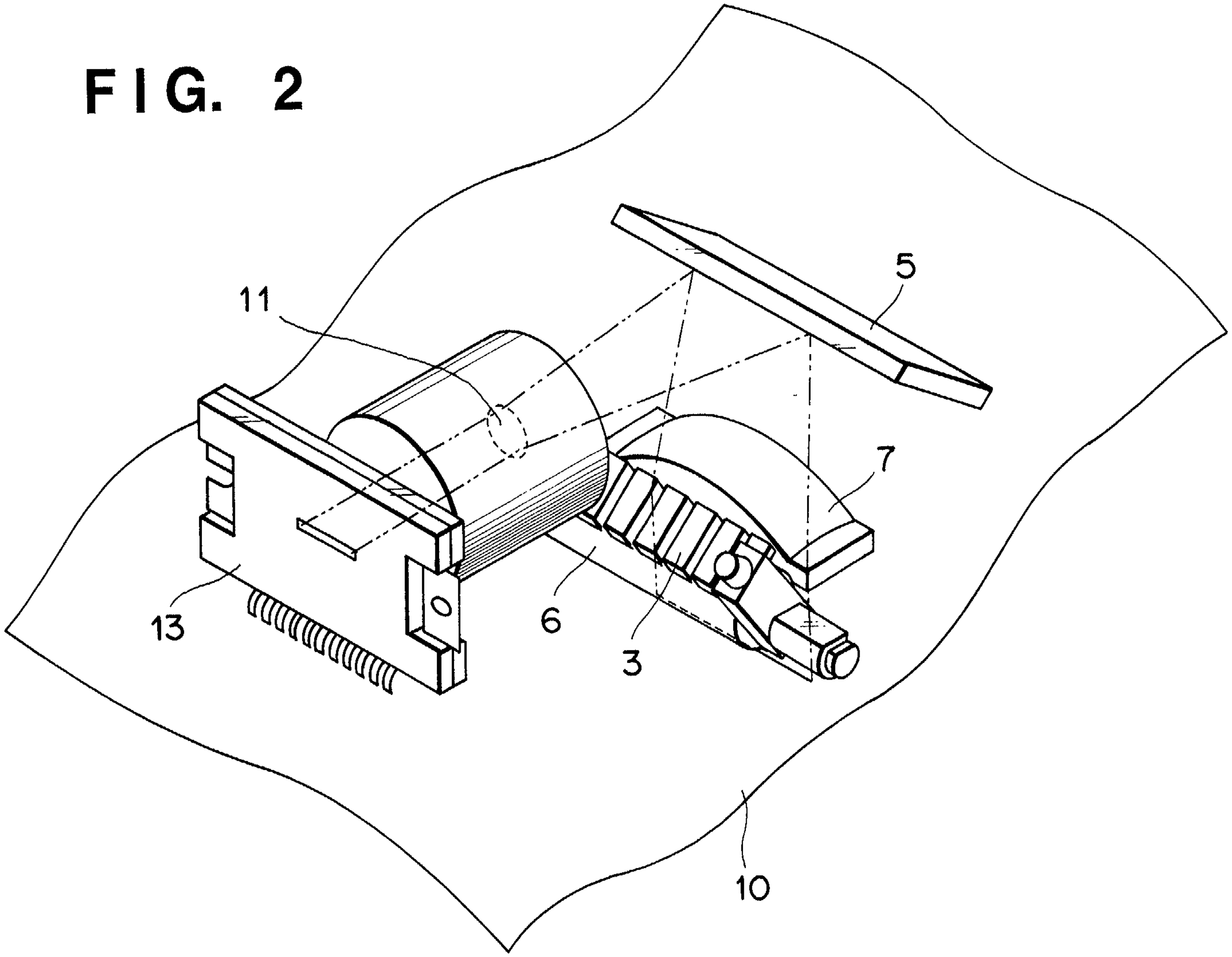


FIG. 2



F I G. 3

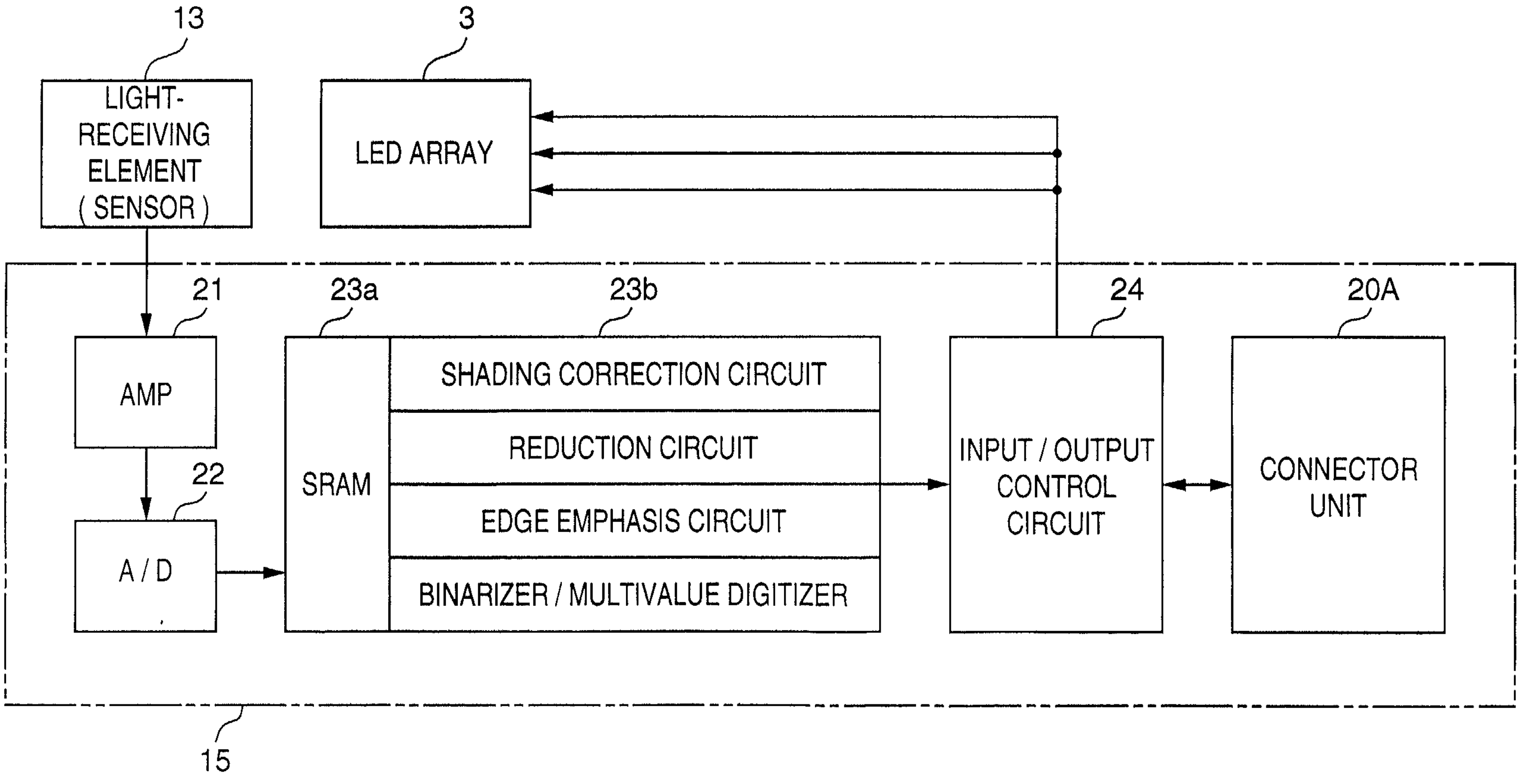

13
LIGHT-RECEIVING ELEMENT (SENSOR)
3
LED ARRAY
21
AMP
22
A / D
23a
SRAM
23b
SHADING CORRECTION CIRCUIT
REDUCTION CIRCUIT
EDGE EMPHASIS CIRCUIT
BINARIZER / MULTIVALUE DIGITIZER
24
INPUT / OUTPUT CONTROL CIRCUIT
20A
CONNECTOR UNIT
15

FIG. 4

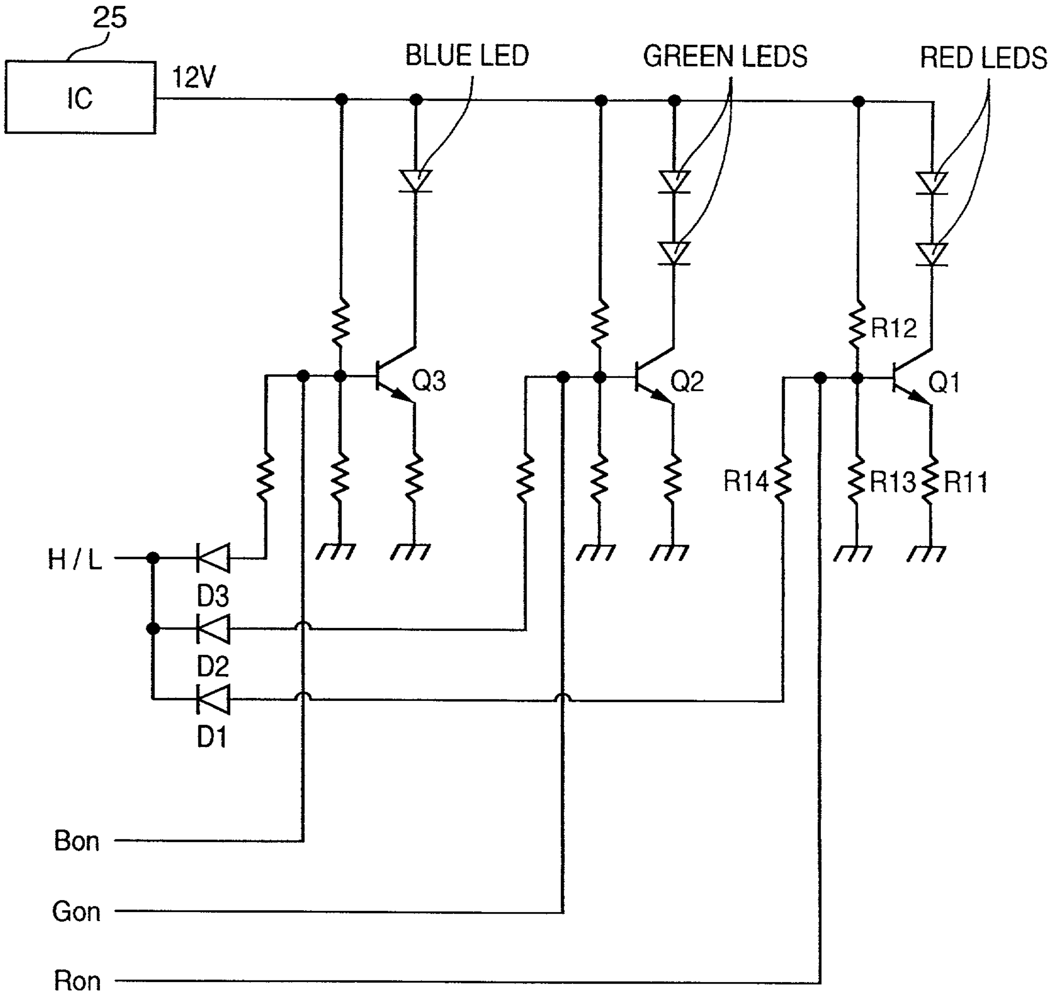
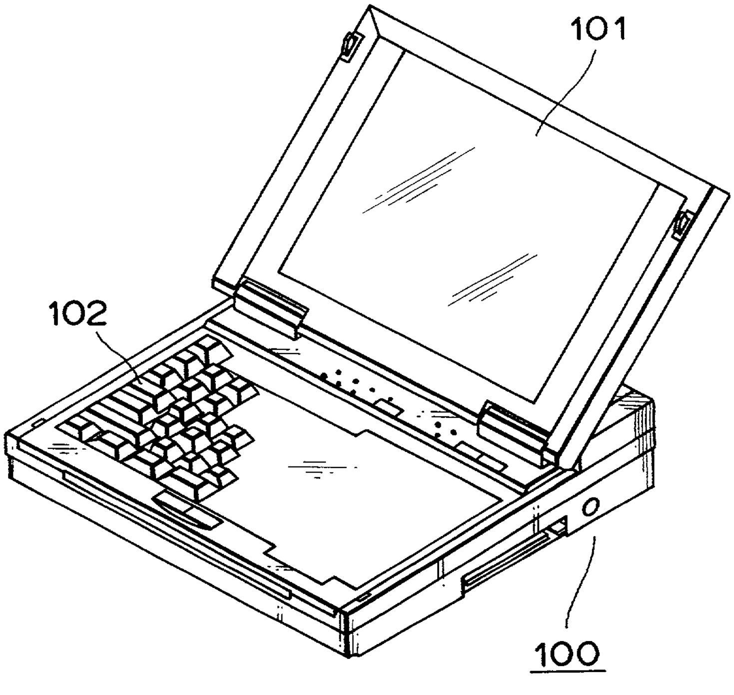

25
IC
12V
BLUE LED
GREEN LEDS
RED LEDS
Q3
Q2
Q1
R12
R14
R13
R11
H / L
D3
D2
D1
Bon
Gon
Ron

FIG. 5



F I G. 6

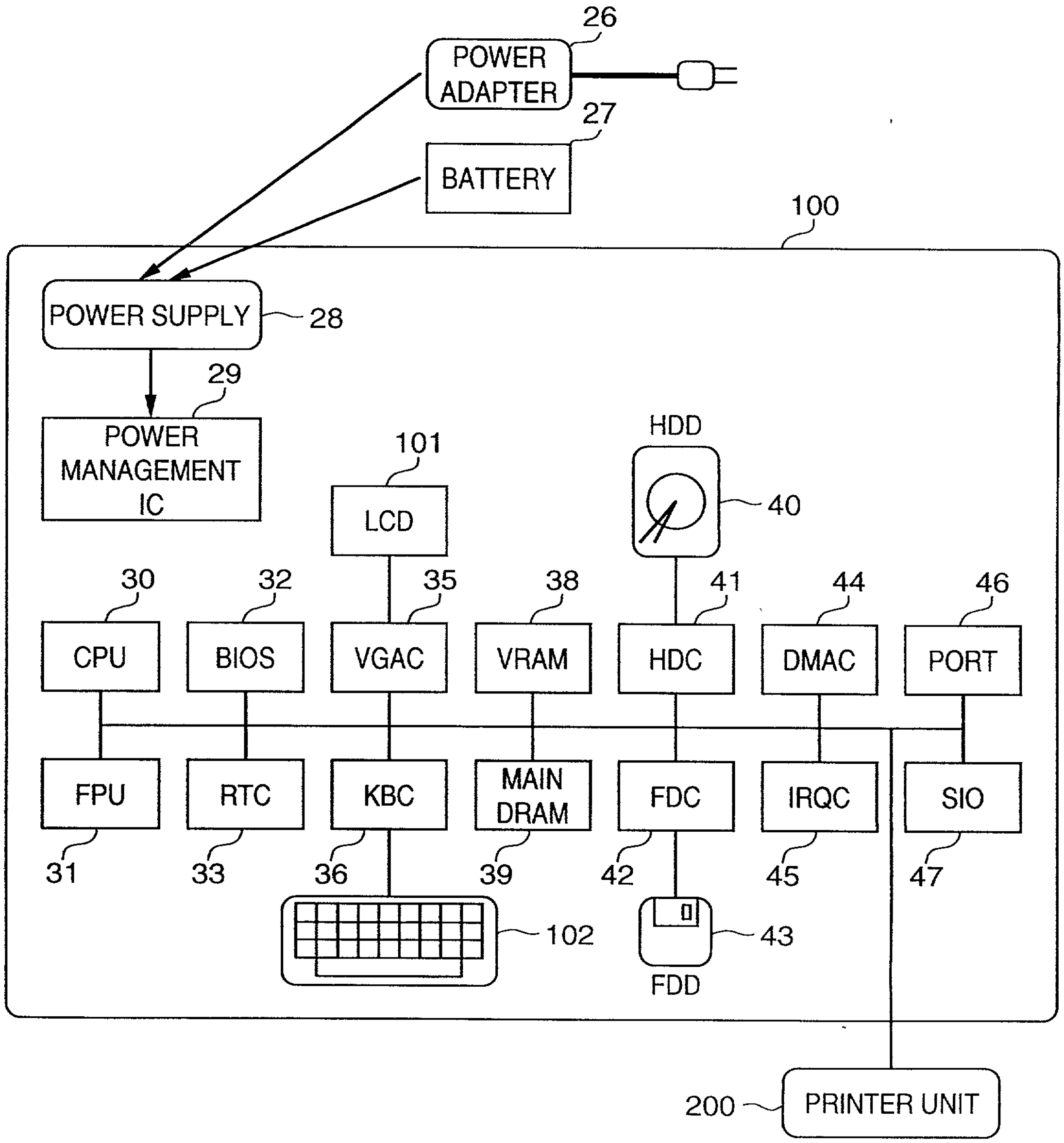

26
POWER ADAPTER
27
BATTERY
100
POWER SUPPLY
28
29
POWER MANAGEMENT IC
101
LCD
HDD
40
30
CPU
32
BIOS
35
VGAC
38
VRAM
41
HDC
44
DMAC
46
PORT
FPU
31
RTC
33
KBC
36
MAIN DRAM
39
FDC
42
IRQC
45
SIO
47
102
43
FDD
200
PRINTER UNIT

FIG. 7

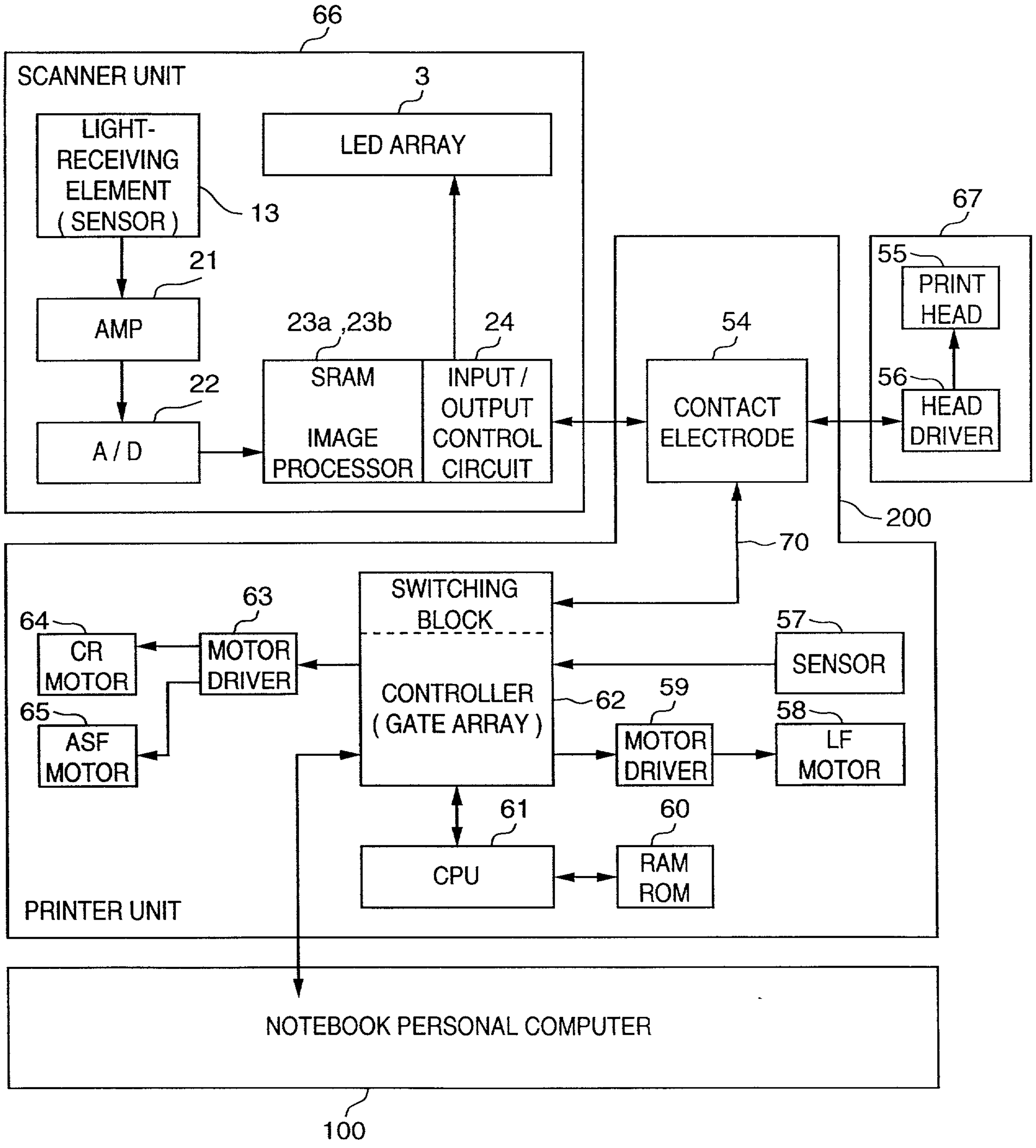

66
SCANNER UNIT
3
LED ARRAY
LIGHT-RECEIVING ELEMENT (SENSOR)
13
21
AMP
22
A / D
23a ,23b
SRAM
IMAGE PROCESSOR
24
INPUT / OUTPUT CONTROL CIRCUIT
54
CONTACT ELECTRODE
67
55
PRINT HEAD
56
HEAD DRIVER
200
70
SWITCHING BLOCK
CONTROLLER (GATE ARRAY)
62
63
MOTOR DRIVER
64
CR MOTOR
65
ASF MOTOR
57
SENSOR
59
MOTOR DRIVER
58
LF MOTOR
61
CPU
60
RAM ROM
PRINTER UNIT
NOTEBOOK PERSONAL COMPUTER
100

FIG. 8

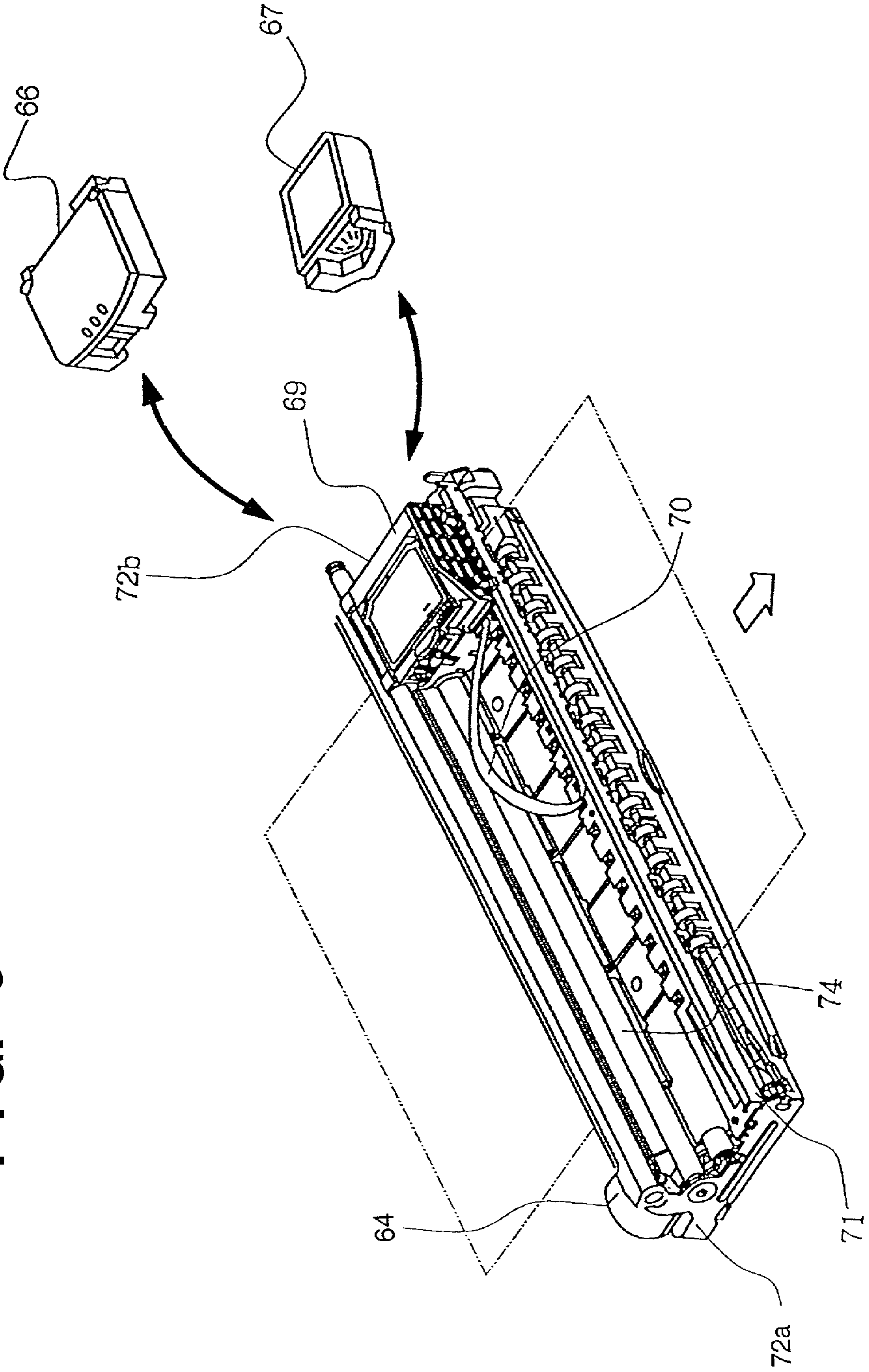


FIG. 9

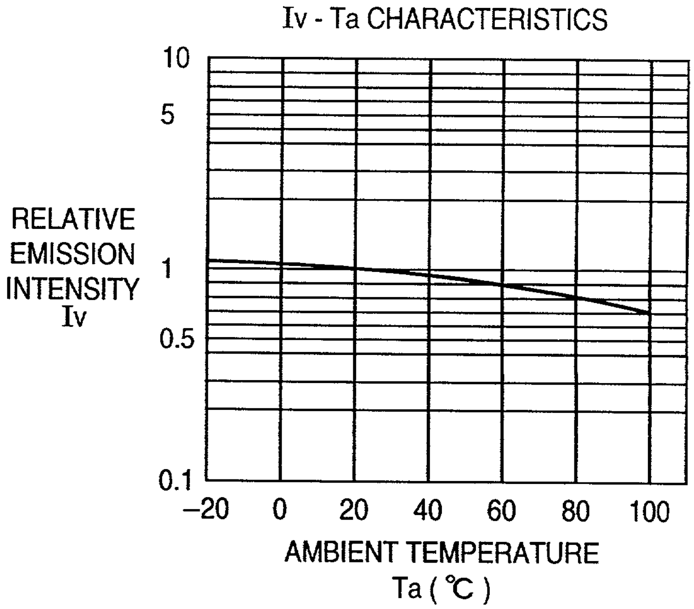

Iv - Ta CHARACTERISTICS
10
5
1
0.5
0.1
RELATIVE EMISSION INTENSITY Iv
−20
0
20
40
60
80
100
AMBIENT TEMPERATURE
Ta (℃)

FIG. 10

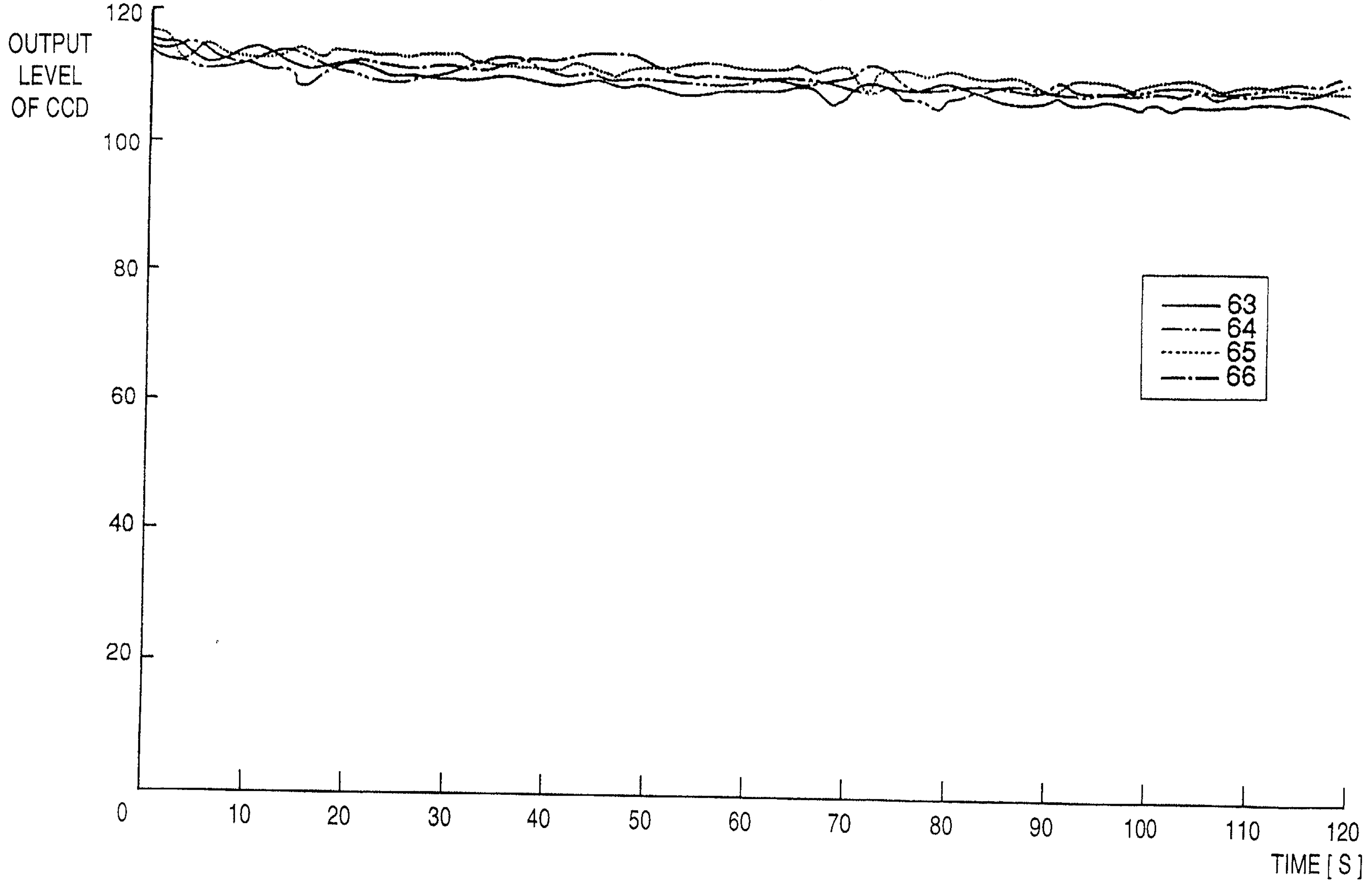

OUTPUT
LEVEL
OF CCD
120
100
80
60
40
20
0
10
20
30
40
50
60
70
80
90
100
110
120
TIME [S]
63
64
65
66

FIG. 11

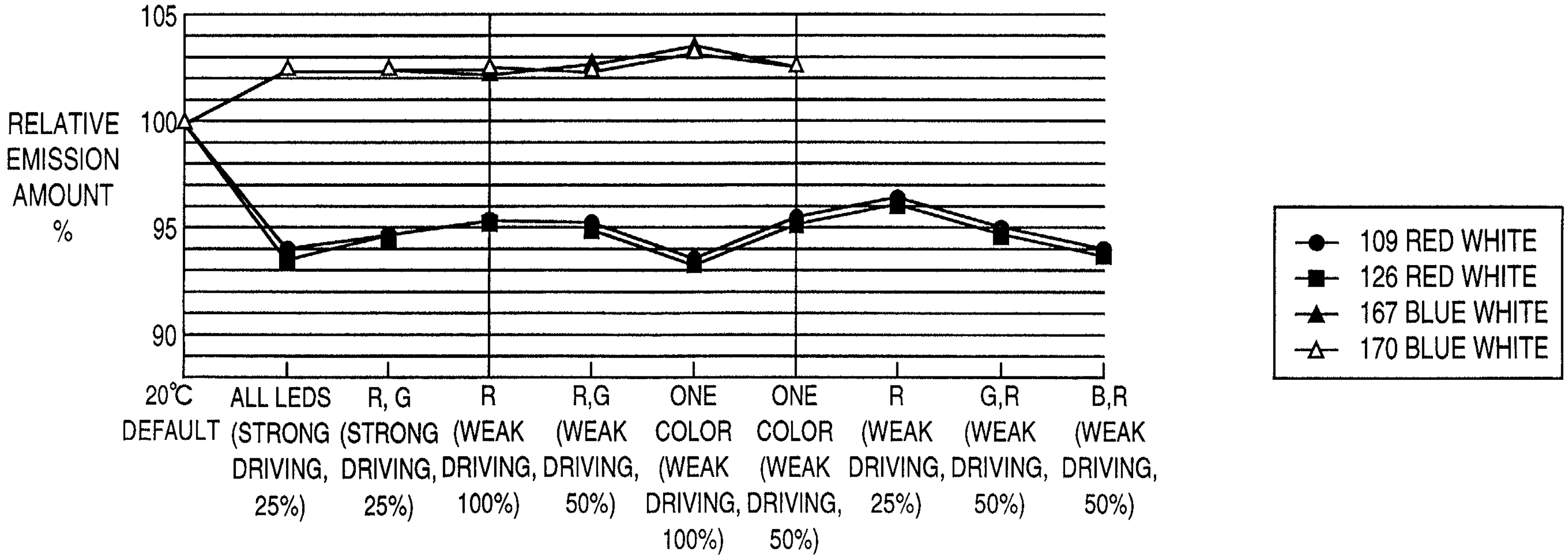

RELATIVE EMISSION AMOUNT %
105
100
95
90
20℃ DEFAULT
ALL LEDS (STRONG DRIVING, 25%)
R, G (STRONG DRIVING, 25%)
R (WEAK DRIVING, 100%)
R,G (WEAK DRIVING, 50%)
ONE COLOR (WEAK DRIVING, 100%)
ONE COLOR (WEAK DRIVING, 50%)
R (WEAK DRIVING, 25%)
G,R (WEAK DRIVING, 50%)
B,R (WEAK DRIVING, 50%)
109 RED WHITE
126 RED WHITE
167 BLUE WHITE
170 BLUE WHITE

FIG. 12A

COLOR MODE

RESOLUTION	ACCUMULATION TIME	FORWARD msec	BACKWARD msec	ONE-LINE TIME msec	DOT WIDTH	NUMBER OF TIMES	A4 TIME msec
360 × 360 dpi ØTR = 0 COLOR	256μsec	3.9K	3.9K		64		
		863.4	863.4	1726.8		66	341906.4
							5'42"
180 × 180 dpi ØTR = 0 COLOR	320μsec	6.25K	6.25K		64		
		545.4	545.4	1090.8		66	215978.4
							3'36"
90 × 90 dpi ØTR = 0 COLOR	307μsec	6.51K	6.51K		64		
		523.6	523.6	1047.2		66	207345.6
							3'27"
200 × 360 dpi ØTR = 0 COLOR	288μsec	6.25K	6.25K		64		
		545.4	545.4	1090.8		66	215978.4
							3'36"
300 × 360 dpi ØTR = 0 COLOR	307μsec	3.9K	3.9K		64		
		863.4	863.4	1726.8		66	341906.4
							5'42"

PAPER FEED TIME : 5 SEC
DELIVERY TIME : 1 SEC

SCAN AREA
HORIZONTAL : 203mm (8 inch)
VERTICAL : 297mm (11.7 inch)

FIG. 12B

MONOCHROME MULTIVALUE MODE

RESOLUTION	ACCUMULATION TIME	FORWARD msec	BACKWARD msec	ONE-LINE TIME msec	DOT WIDTH	NUMBER OF TIMES	A4 TIME msec
360 × 360 dpi ØTR = 0 MONO	256μsec	3.9K	3.9K		64		
		863.4	863.4	1726.8		66	113968.8
							1'54"
180 × 180 dpi ØTR = 0 MONO	320μsec	6.25K	6.25K		64		
		545.4	545.4	1090.8		66	71992.8
							1'12"
90 × 90 dpi ØTR = 0 MONO	307μsec	6.51K	6.51K		64		
		523.6	523.6	1047.2		66	69115.2
							1'09"
200 × 360 dpi ØTR = 0 MONO	288μsec	6.25K	6.25K		64		
		545.4	545.4	1090.8		66	71992.8
							1'12"
300 × 360 dpi ØTR = 0 MONO	307μsec	3.9K	3.9K		64		
		863.4	863.4	1726.8		66	113968.8
							1'54"

PAPER FEED TIME : 5 SEC
DELIVERY TIME : 1 SEC

SCAN AREA
HORIZONTAL : 203mm (8 inch)
VERTICAL : 297mm (11.7 inch)

F I G. 12C

MONOCHROME BINARY MODE

RESOLUTION	ACCUMU-LATION TIME	FORWARD msec	BACKWARD msec	ONE-LINE TIME msec	DOT WIDTH	NUMBER OF TIMES	A4 TIME msec
360 × 360 dpi	256µsec	3.9K	3.9K		64		
∅TR = 0 MONO		863.4	863.4	1726.8		66	113968.8
							1'54"
180 × 180 dpi	320µsec	6.25K	6.25K		64		
∅TR = 0 MONO		545.4	545.4	1090.8		66	71992.8
							1'12"
90 × 90 dpi	307µsec	6.51K	6.51K		64		
∅TR = 0 MONO		523.6	523.6	1047.2		66	69115.2
							1'09"
200 × 360 dpi	288µsec	6.25K	6.25K		64		
∅TR = 0 MONO		545.4	545.4	1090.8		66	71992.8
							1'12"
300 × 360 dpi	307µsec	3.9K	3.9K		64		
∅TR = 0 MONO		863.4	863.4	1726.8		66	113968.8
							1'54"

PAPER FEED TIME : 5 SEC
DELIVERY TIME : 1 SEC

SCAN AREA
HORIZONTAL : 203mm (8 inch)
VERTICAL : 297mm (11.7 inch)

FIG. 13

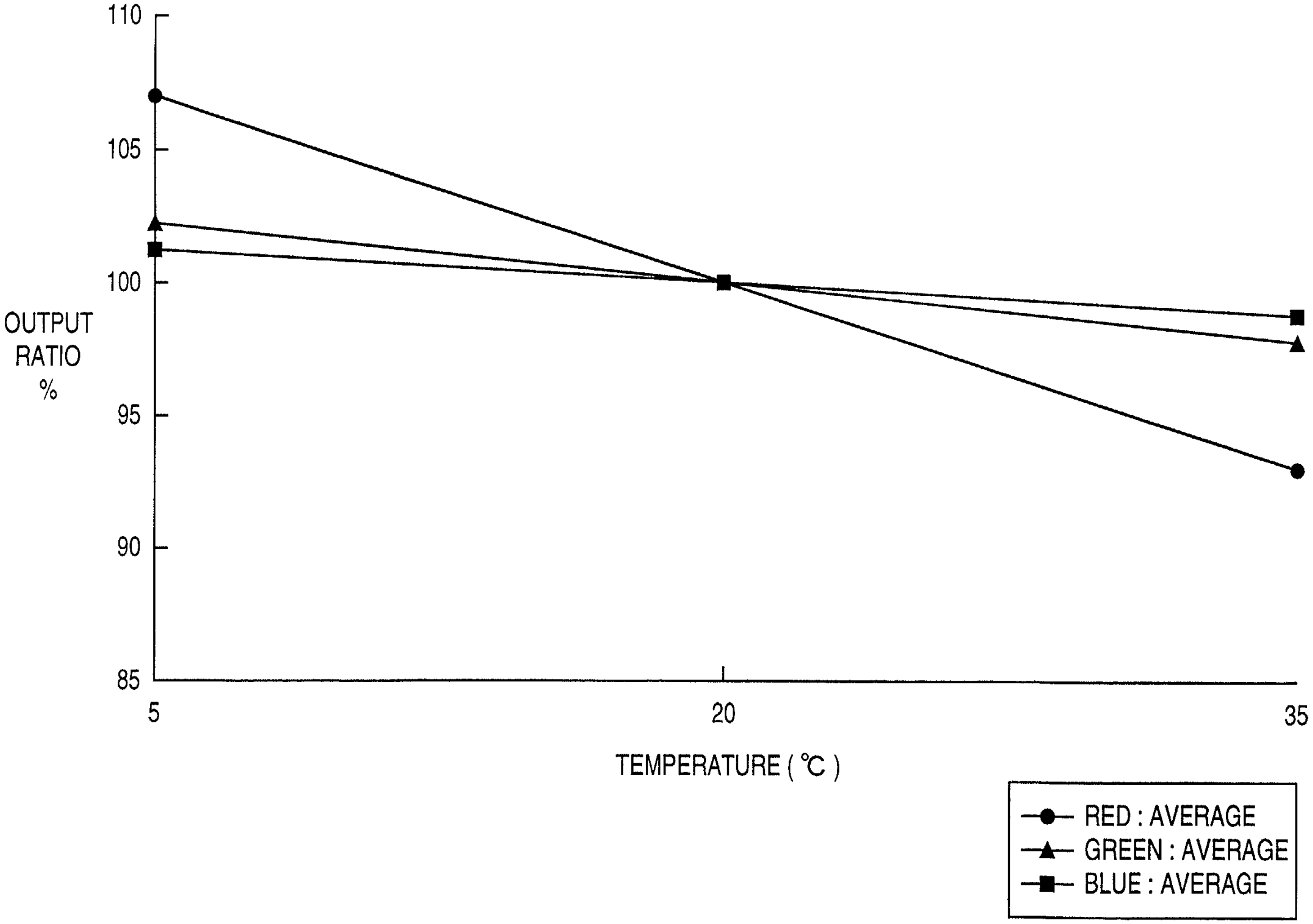
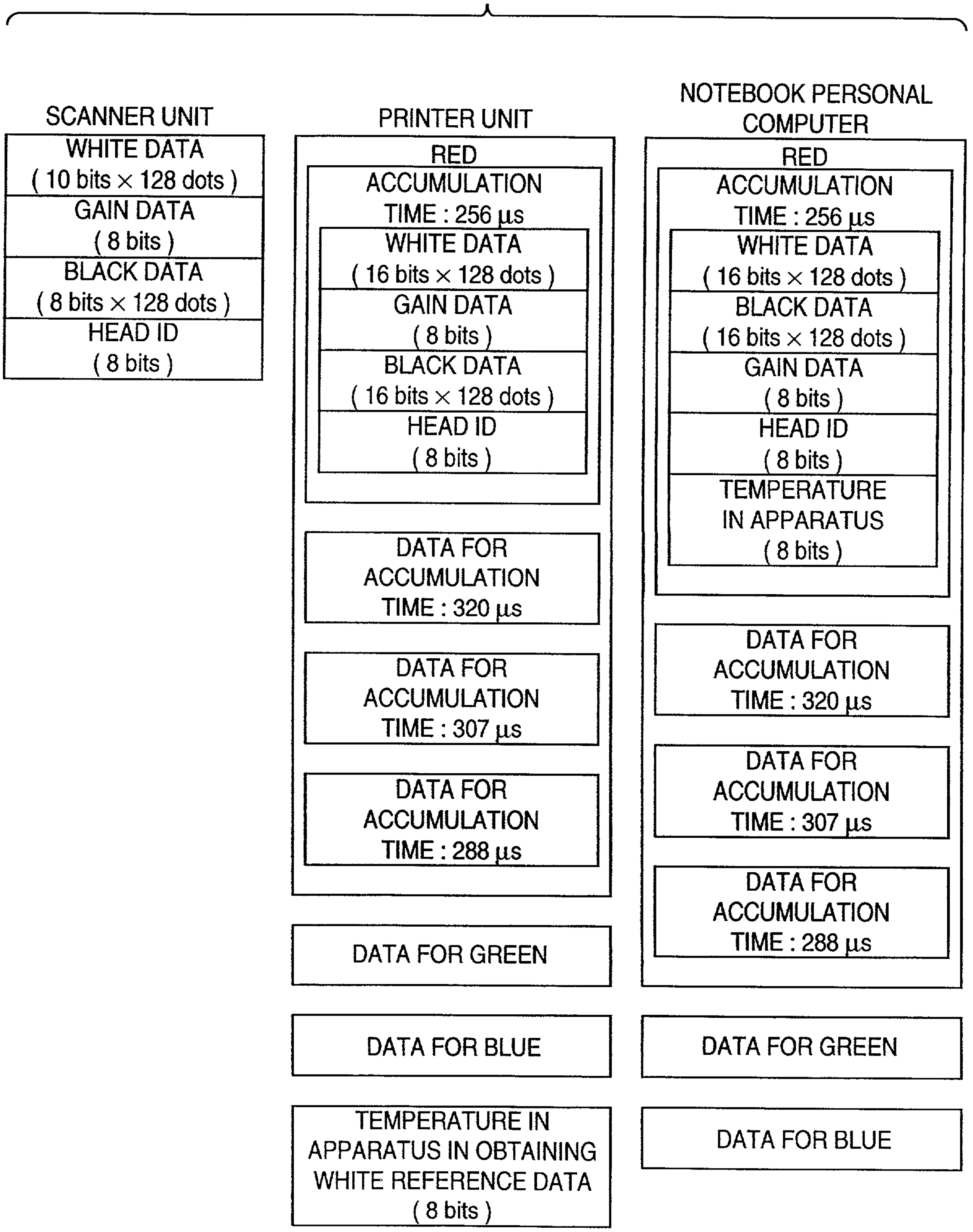
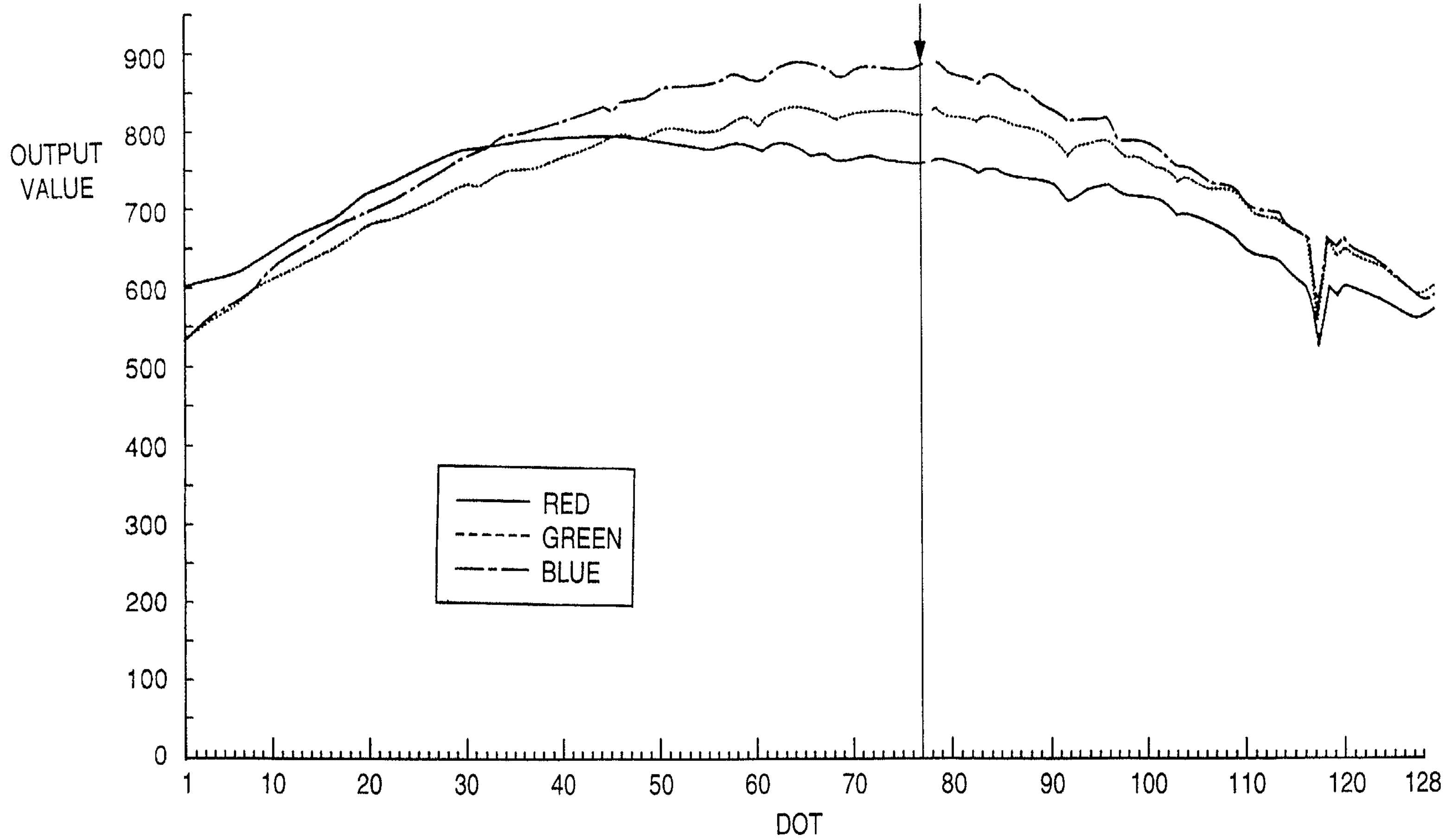

110
105
100
95
90
85
OUTPUT
RATIO
%
5
20
35
TEMPERATURE (℃)
● RED : AVERAGE
▲ GREEN : AVERAGE
■ BLUE : AVERAGE

FIG. 14

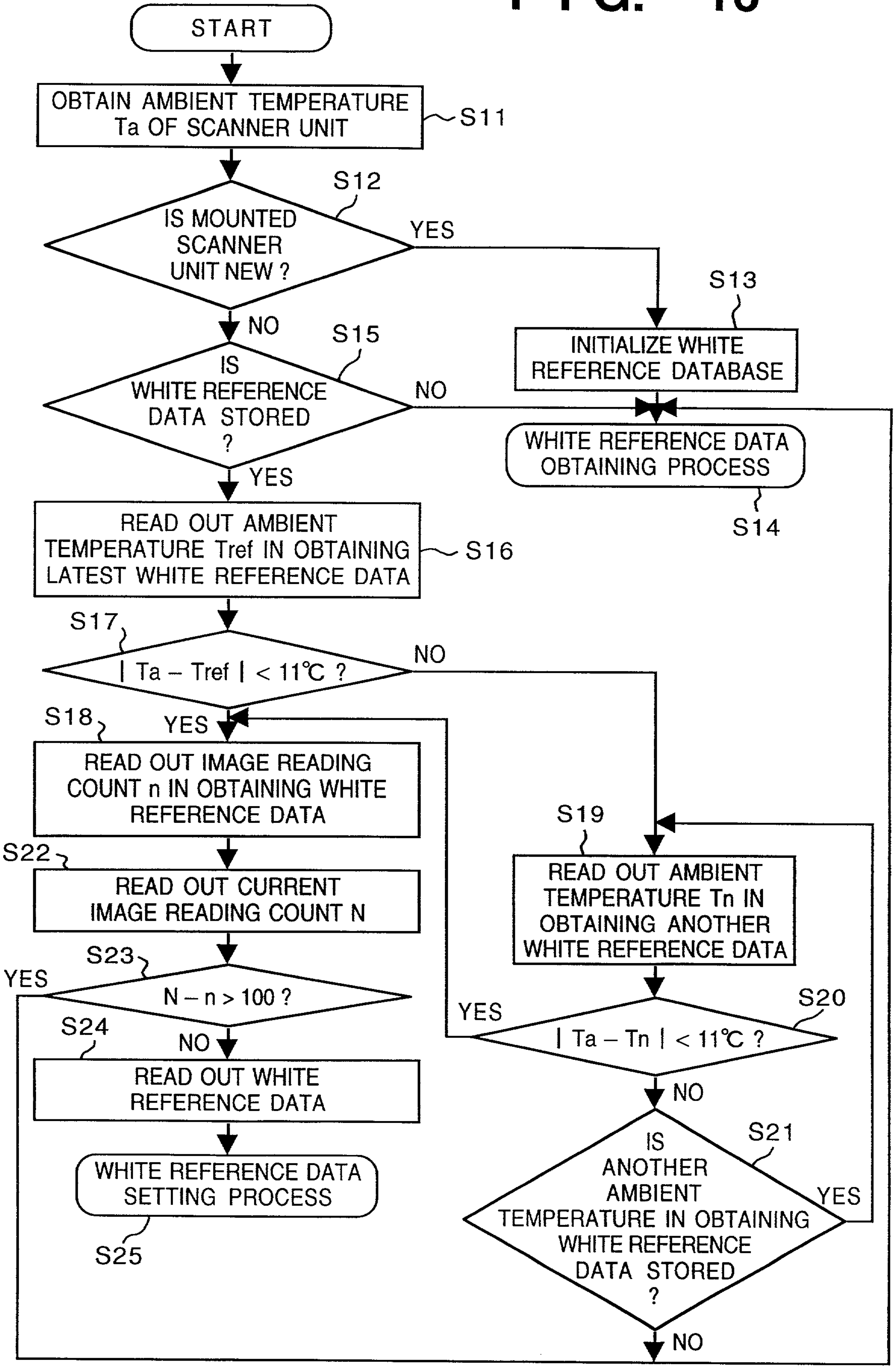

SCANNER UNIT
WHITE DATA (10 bits × 128 dots)
GAIN DATA (8 bits)
BLACK DATA (8 bits × 128 dots)
HEAD ID (8 bits)
PRINTER UNIT
RED
ACCUMULATION TIME : 256 µs
WHITE DATA (16 bits × 128 dots)
GAIN DATA (8 bits)
BLACK DATA (16 bits × 128 dots)
HEAD ID (8 bits)
DATA FOR ACCUMULATION TIME : 320 µs
DATA FOR ACCUMULATION TIME : 307 µs
DATA FOR ACCUMULATION TIME : 288 µs
DATA FOR GREEN
DATA FOR BLUE
TEMPERATURE IN APPARATUS IN OBTAINING WHITE REFERENCE DATA (8 bits)
NOTEBOOK PERSONAL COMPUTER
RED
ACCUMULATION TIME : 256 µs
WHITE DATA (16 bits × 128 dots)
BLACK DATA (16 bits × 128 dots)
GAIN DATA (8 bits)
HEAD ID (8 bits)
TEMPERATURE IN APPARATUS (8 bits)
DATA FOR ACCUMULATION TIME : 320 µs
DATA FOR ACCUMULATION TIME : 307 µs
DATA FOR ACCUMULATION TIME : 288 µs
DATA FOR GREEN
DATA FOR BLUE

F I G. 15

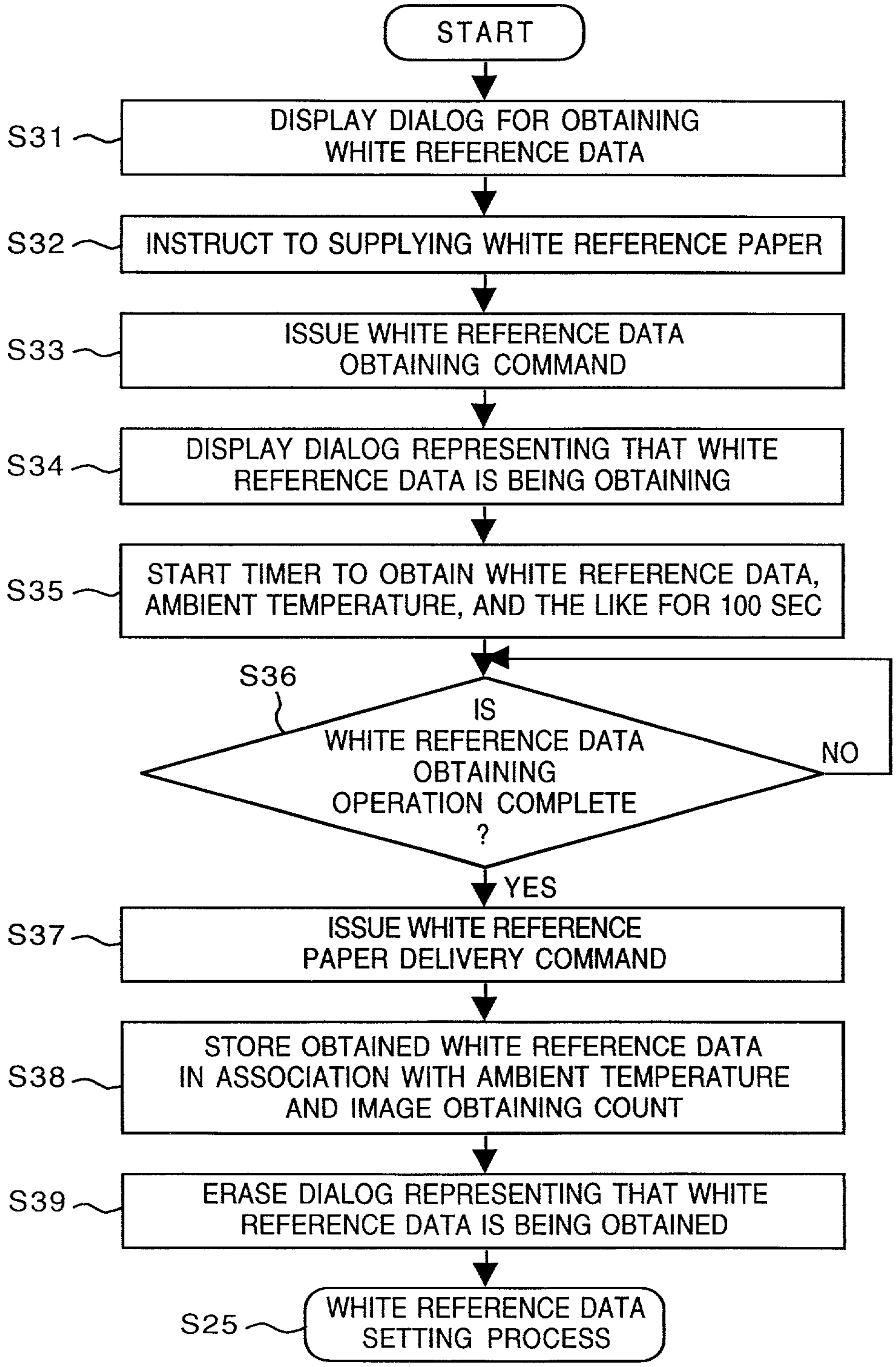
ATMOSPHERE : ROOM TEMPERATURE (25℃)
LNST : 256 μ SEC



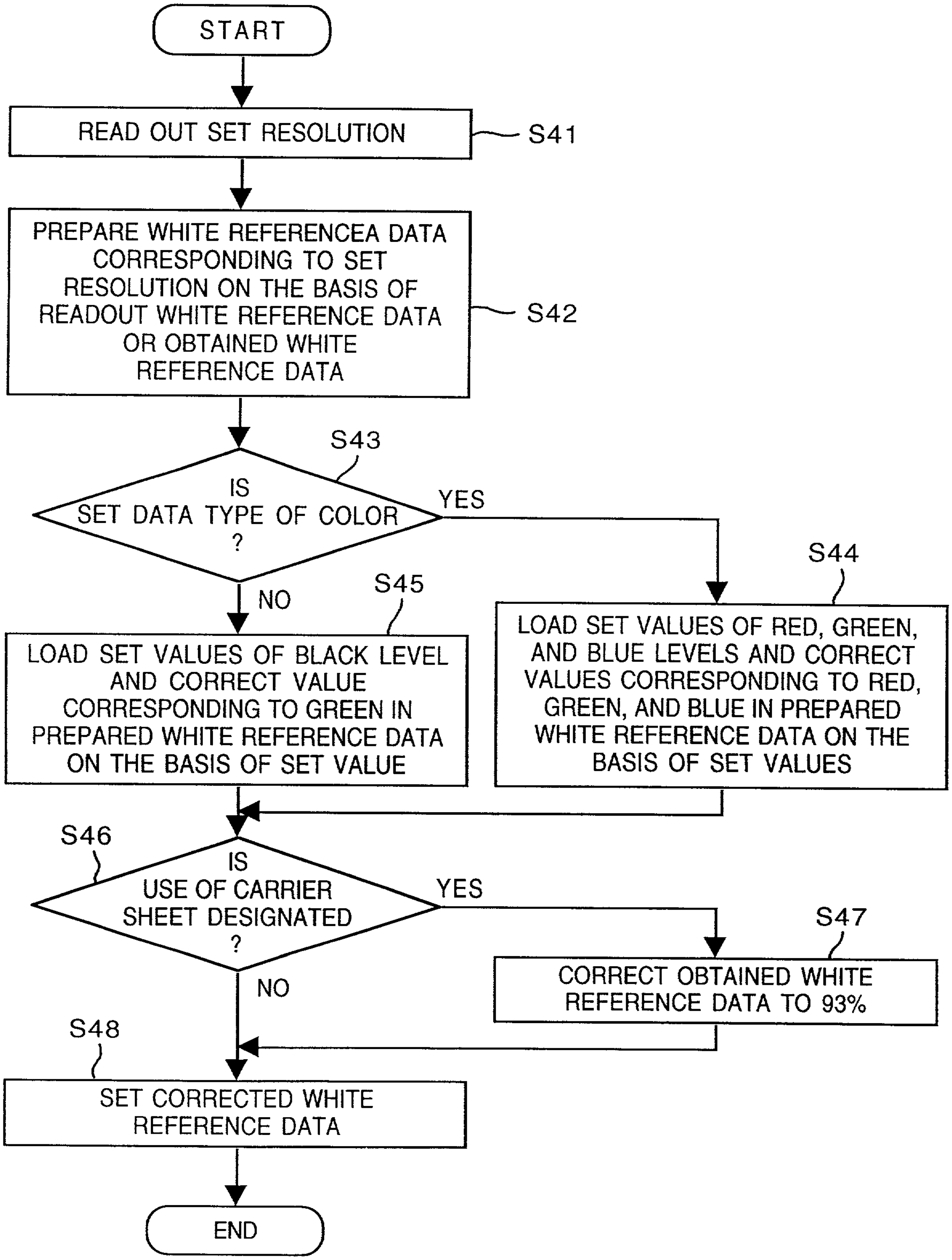
F I G. 16


START
OBTAIN AMBIENT TEMPERATURE Ta OF SCANNER UNIT
S11
S12
IS MOUNTED SCANNER UNIT NEW ?
YES
NO
S13
INITIALIZE WHITE REFERENCE DATABASE
S15
IS WHITE REFERENCE DATA STORED ?
NO
YES
WHITE REFERENCE DATA OBTAINING PROCESS
S14
READ OUT AMBIENT TEMPERATURE Tref IN OBTAINING LATEST WHITE REFERENCE DATA
S16
S17
| Ta – Tref | < 11℃ ?
NO
S18
YES
READ OUT IMAGE READING COUNT n IN OBTAINING WHITE REFERENCE DATA
S19
READ OUT AMBIENT TEMPERATURE Tn IN OBTAINING ANOTHER WHITE REFERENCE DATA
S22
READ OUT CURRENT IMAGE READING COUNT N
S23
YES
N – n > 100 ?
S24
NO
READ OUT WHITE REFERENCE DATA
YES
| Ta – Tn | < 11℃ ?
S20
NO
S21
IS ANOTHER AMBIENT TEMPERATURE IN OBTAINING WHITE REFERENCE DATA STORED ?
YES
WHITE REFERENCE DATA SETTING PROCESS
S25
NO

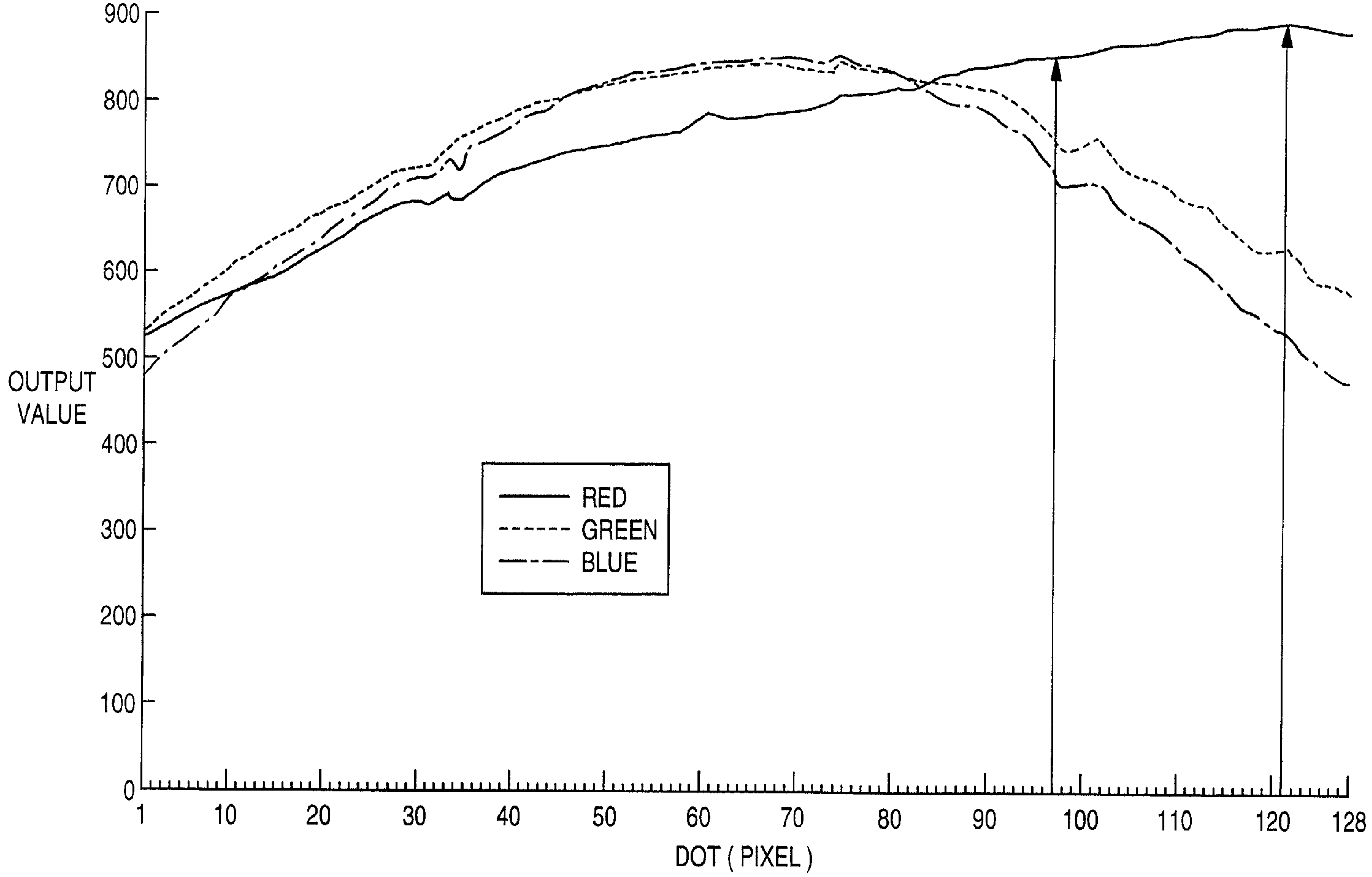
F I G. 17


START
S31
DISPLAY DIALOG FOR OBTAINING WHITE REFERENCE DATA
S32
INSTRUCT TO SUPPLYING WHITE REFERENCE PAPER
S33
ISSUE WHITE REFERENCE DATA OBTAINING COMMAND
S34
DISPLAY DIALOG REPRESENTING THAT WHITE REFERENCE DATA IS BEING OBTAINING
S35
START TIMER TO OBTAIN WHITE REFERENCE DATA, AMBIENT TEMPERATURE, AND THE LIKE FOR 100 SEC
S36
IS WHITE REFERENCE DATA OBTAINING OPERATION COMPLETE ?
NO
YES
S37
ISSUE WHITE REFERENCE PAPER DELIVERY COMMAND
S38
STORE OBTAINED WHITE REFERENCE DATA IN ASSOCIATION WITH AMBIENT TEMPERATURE AND IMAGE OBTAINING COUNT
S39
ERASE DIALOG REPRESENTING THAT WHITE REFERENCE DATA IS BEING OBTAINED
S25
WHITE REFERENCE DATA SETTING PROCESS

F I G. 18


START
READ OUT SET RESOLUTION
S41
PREPARE WHITE REFERENCEA DATA CORRESPONDING TO SET RESOLUTION ON THE BASIS OF READOUT WHITE REFERENCE DATA OR OBTAINED WHITE REFERENCE DATA
S42
S43
IS SET DATA TYPE OF COLOR ?
YES
NO
S44
LOAD SET VALUES OF RED, GREEN, AND BLUE LEVELS AND CORRECT VALUES CORRESPONDING TO RED, GREEN, AND BLUE IN PREPARED WHITE REFERENCE DATA ON THE BASIS OF SET VALUES
S45
LOAD SET VALUES OF BLACK LEVEL AND CORRECT VALUE CORRESPONDING TO GREEN IN PREPARED WHITE REFERENCE DATA ON THE BASIS OF SET VALUE
S46
IS USE OF CARRIER SHEET DESIGNATED ?
YES
NO
S47
CORRECT OBTAINED WHITE REFERENCE DATA TO 93%
S48
SET CORRECTED WHITE REFERENCE DATA
END

F I G. 19


OUTPUT
VALUE
900
800
700
600
500
400
300
200
100
0
1
10
20
30
40
50
60
70
80
90
100
110
120
128
DOT (PIXEL)
RED
GREEN
BLUE

F I G. 20

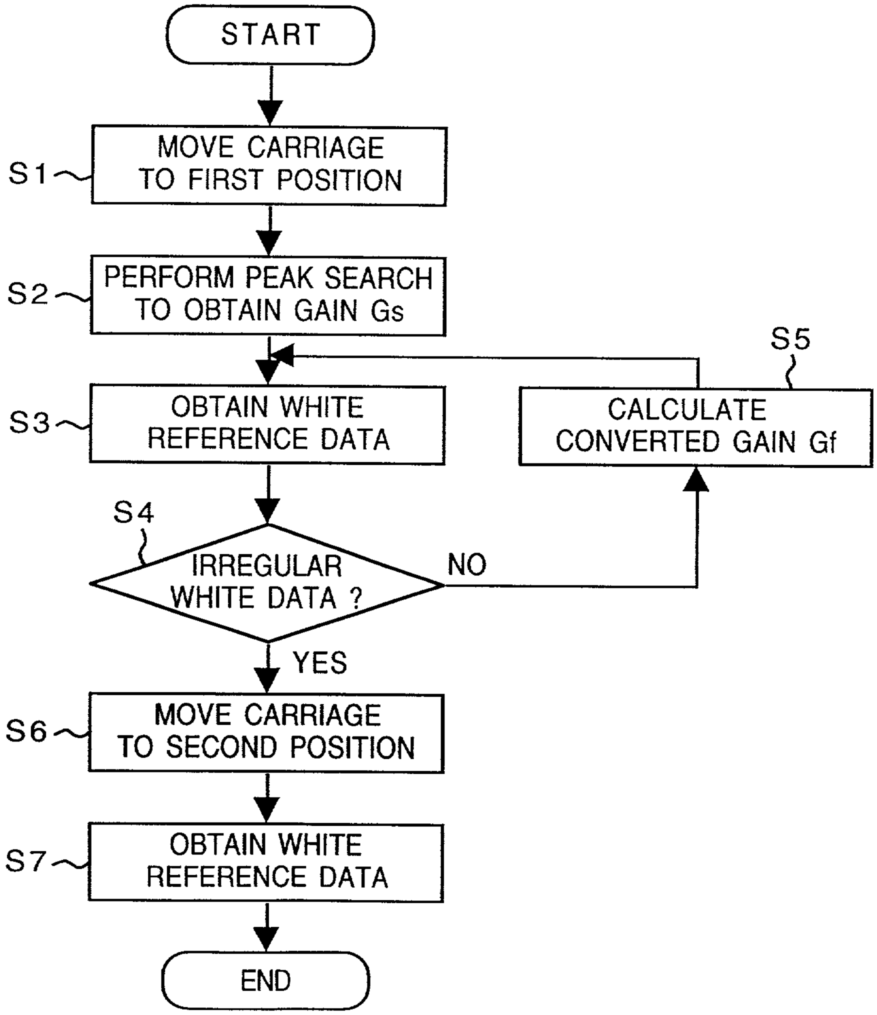
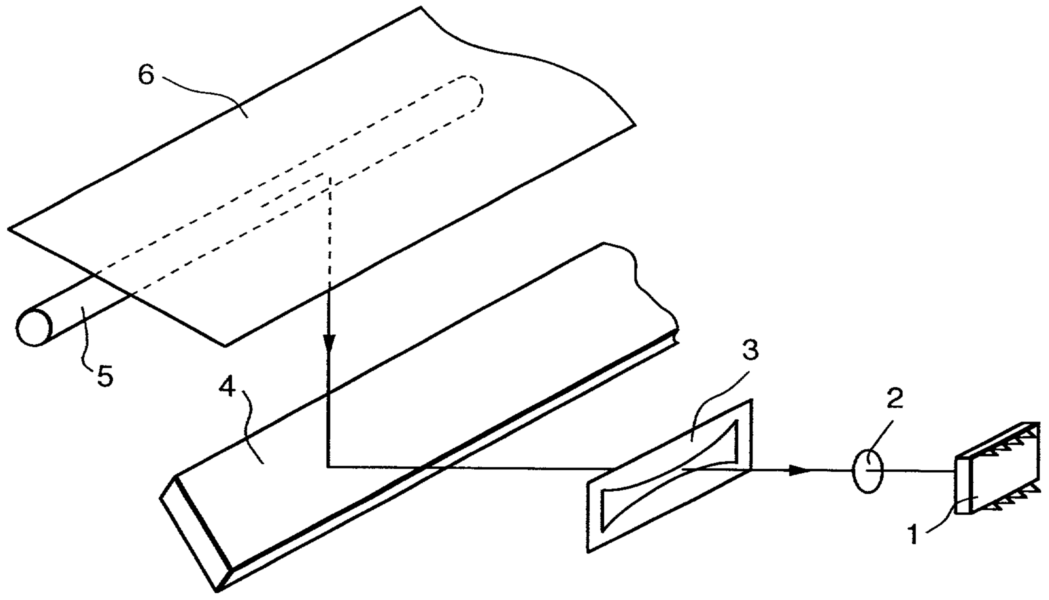

START
S1
MOVE CARRIAGE TO FIRST POSITION
S2
PERFORM PEAK SEARCH TO OBTAIN GAIN Gs
S3
OBTAIN WHITE REFERENCE DATA
S5
CALCULATE CONVERTED GAIN Gf
S4
IRREGULAR WHITE DATA ?
NO
YES
S6
MOVE CARRIAGE TO SECOND POSITION
S7
OBTAIN WHITE REFERENCE DATA
END

FIG. 21
(PRIOR ART)



F I G. 22A

0	WHITE REFERENCE DATA OBTAINING COUNT
1	TEMPERATURE IN OBTAINING FIRST REFERENCE DATA
2	TEMPERATURE IN OBTAINING SECOND REFERENCE DATA
3	TEMPERATURE IN OBTAINING THIRD REFERENCE DATA
4	TEMPERATURE IN OBTAINING FOURTH REFERENCE DATA
5	TEMPERATURE IN OBTAINING FIFTH REFERENCE DATA
6 ⋯ 15	SUPPLEMENTARY AREA

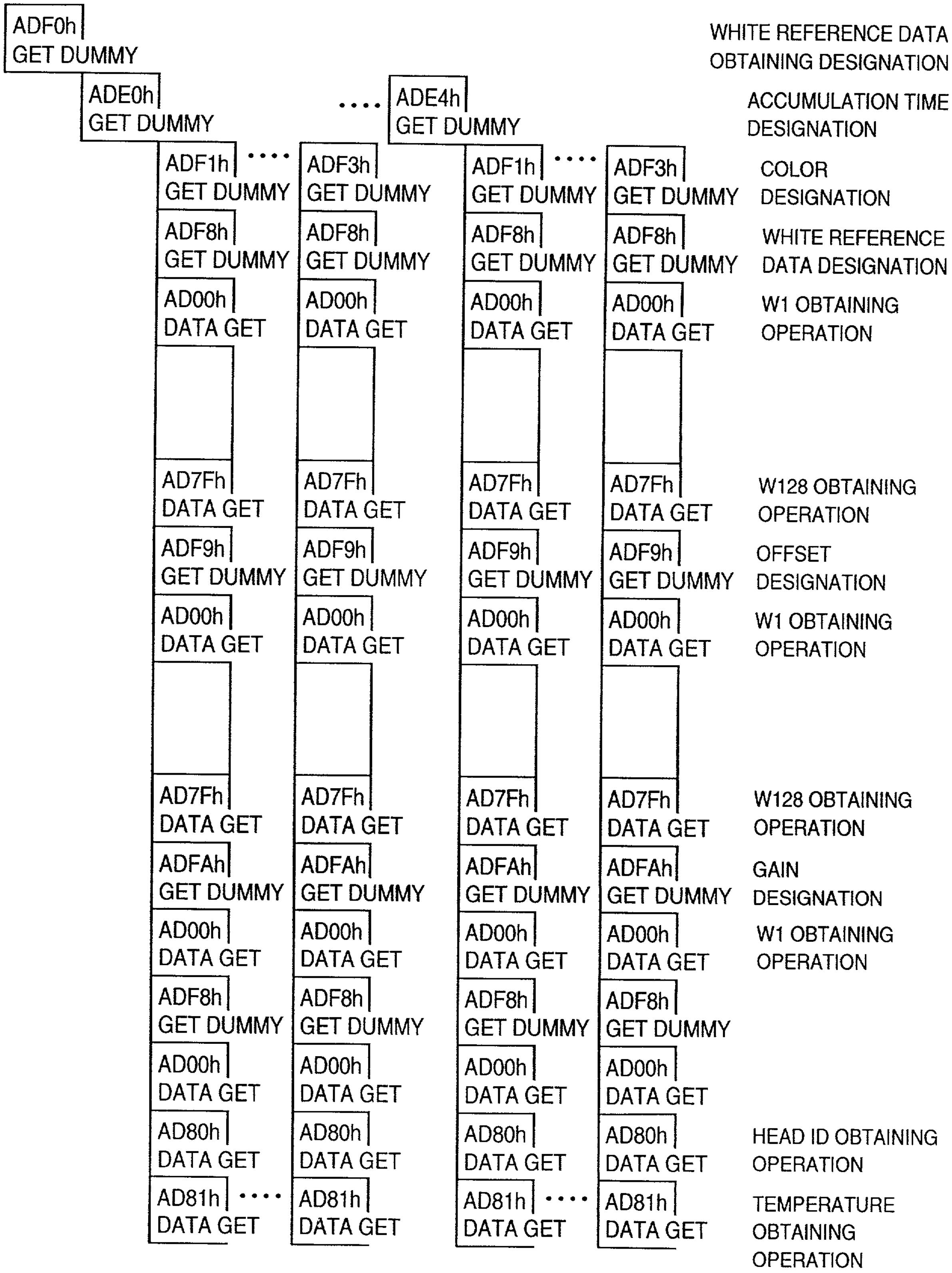
F I G. 22B

- FIRST WHITE REFERENCE DATA
  - TIME STAMP
  - WHITE REFERENCE DATA FOR ACCUMULATION TIME OF 256 µs
    - WHITE REFERENCE DATA FOR RED
      - WHITE DATA 1 ⋯ WHITE DATA 128
      - BLACK DATA 1 ⋯ BLACK DATA 128
      - GAIN | SUPPLEMENTARY | ID | TEMPERATURE
    - WHITE REFERENCE DATA FOR GREEN
    - WHITE REFERENCE DATA FOR BLUE
  - WHITE REFERENCE DATA FOR ACCUMULATION TIME OF 320 µs
  - WHITE REFERENCE DATA FOR ACCUMULATION TIME OF 307 µs
  - WHITE REFERENCE DATA FOR ACCUMULATION TIME OF 288 µs
  - WHITE REFERENCE DATA FOR ACCUMULATION TIME OF 307 µs
- SECOND WHITE REFERENCE DATA
- THIRD WHITE REFERENCE DATA
- FOURTH WHITE REFERENCE DATA
- FIFTH WHITE REFERENCE DATA

F I G. 23

COMMAND PARAMETER	COMMAND CONTENTS
1000H	PORT INITIALIZATION
3000H ~	LEFT OFFSET VALUE DESIGNATION
4000H	PRINT IMAGE TRANSFER
8000H ~	SCANNER READING COMMAND
9000H ~	FEED
9FF0H	DELIVERY
9FF1H	PAPER FEED
A700H	OPERATION FOR OBTAINING CURRENT HEAD TEMPERATURE AND TEMPERATURE IN APPARATUS
A801H	OPERATION FOR OBTAINING MOUNTED HEAD INFORMATION
A809H	OPERATION FOR OBTAINING MOUNTED HEAD ID
AD00H ~ AD7FH	OPERATION FOR OBTAINING WHITE REFERENCE DATA FOR EACH DOT
AD80H	OPERATION FOR OBTAINING HEAD ID IN OBTAINING WHITE REFERENCE DATA
AD81H	OPERATION FOR OBTAINING TEMPERATURE IN OBTAINING WHITE REFERENCE DATA
ADE0H ~ ADE4H	ACCUMULATION TIME DESIGNATION
ADF0H	WHITE REFERENCE DATA OBTAINING DESIGNATION
ADF1H ~ ADF3H	R, G, AND B DESIGNATION
ADF8H	WHITE REFERENCE DATA DESIGNATION
ADF9H	OFFSET DESIGNATION
ADFAH	GAIN DESIGNATION
ADFBH	SUPPLEMENTARY
BD00H ~ BD7FH	WHITE REFERENCE DATA SETTING FOR EACH DOT
BD80H	HEAD ID SETTING
BD81H	TEMPERATURE SETTING
BDE0H ~ BDE4H	ACCUMULATION TIME SETTING
BDF0H	MONOCHROME DESIGNATION
BDF1H ~ BDF3H	R, G, AND B DESIGNATION
BDF8H	WHITE REFERENCE DATA DESIGNATION
BDF9H	OFFSET DESIGNATION
BDFAH	GAIN DESIGNATION
BDFBH	SUPPLEMENTARY
D000H	START OF HEAD EXCHANGE
D100H	END OF HEAD EXCHANGE

F I G. 24


ADF0h GET DUMMY
ADE0h GET DUMMY
....
ADE4h GET DUMMY
ADF1h GET DUMMY
....
ADF3h GET DUMMY
ADF8h GET DUMMY
AD00h DATA GET
AD7Fh DATA GET
ADF9h GET DUMMY
AD00h DATA GET
AD7Fh DATA GET
ADFAh GET DUMMY
AD00h DATA GET
ADF8h GET DUMMY
AD00h DATA GET
AD80h DATA GET
AD81h DATA GET
....
WHITE REFERENCE DATA OBTAINING DESIGNATION
ACCUMULATION TIME DESIGNATION
COLOR DESIGNATION
WHITE REFERENCE DATA DESIGNATION
W1 OBTAINING OPERATION
W128 OBTAINING OPERATION
OFFSET DESIGNATION
W1 OBTAINING OPERATION
W128 OBTAINING OPERATION
GAIN DESIGNATION
W1 OBTAINING OPERATION
HEAD ID OBTAINING OPERATION
TEMPERATURE OBTAINING OPERATION

F I G. 25

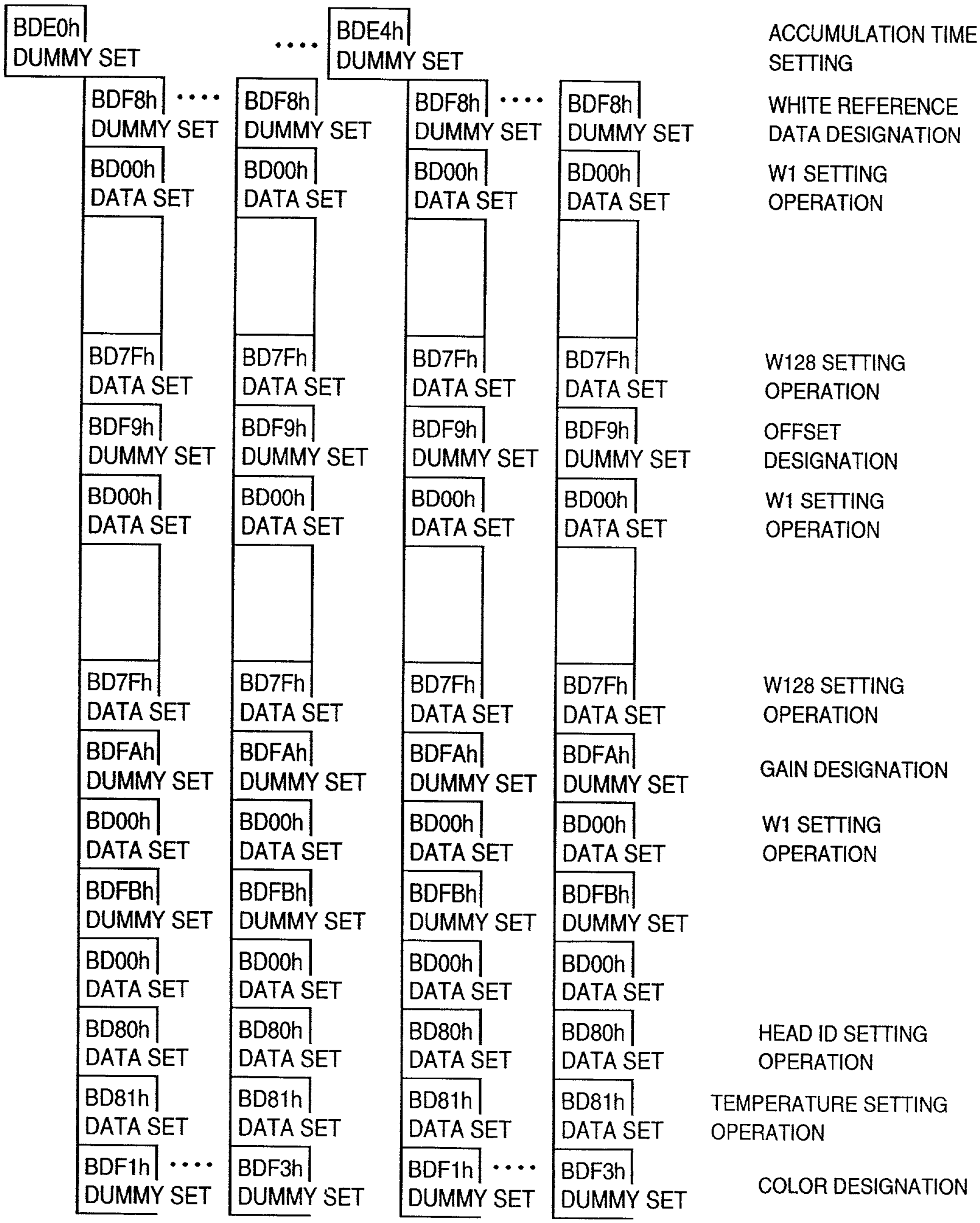
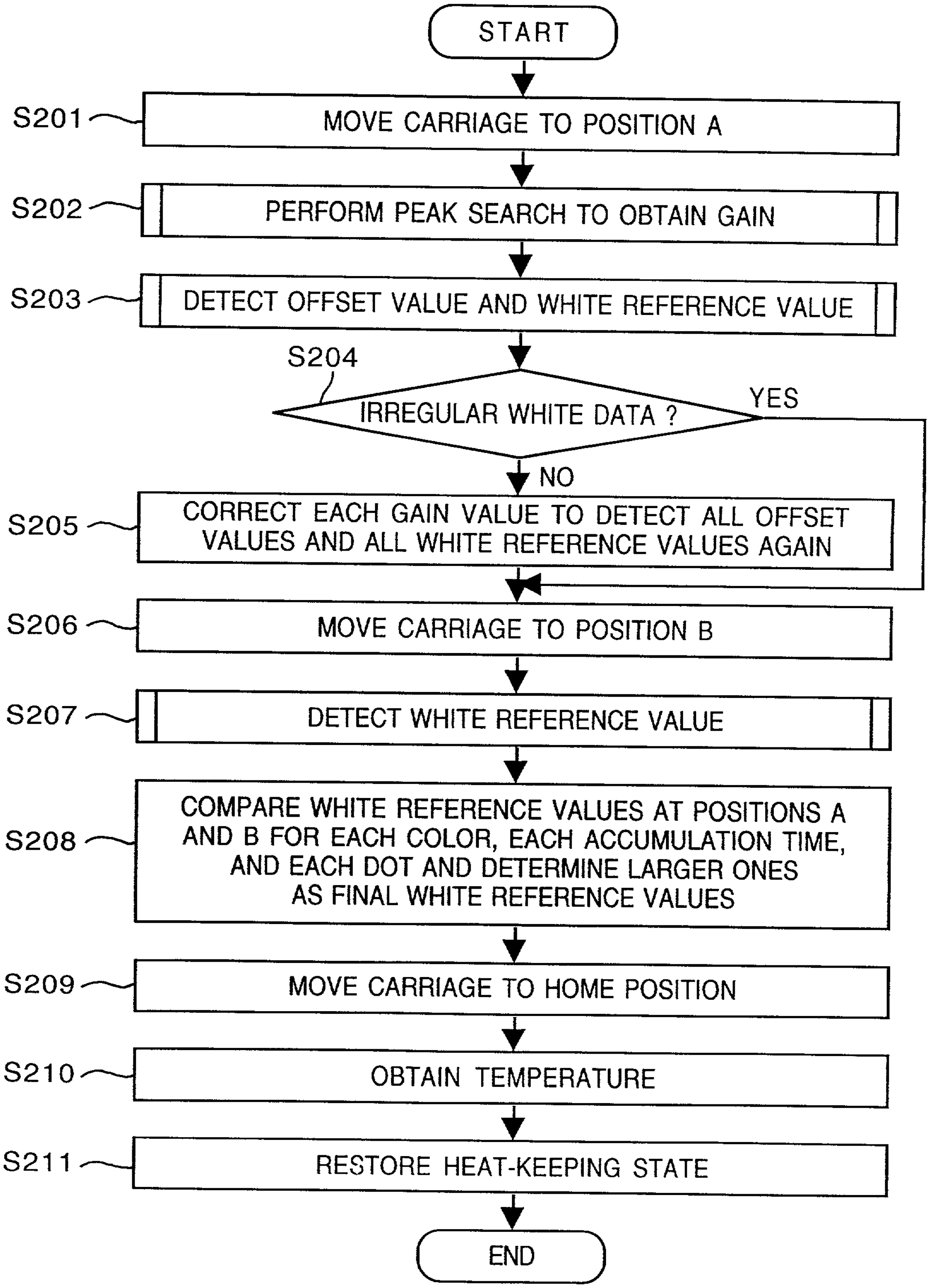
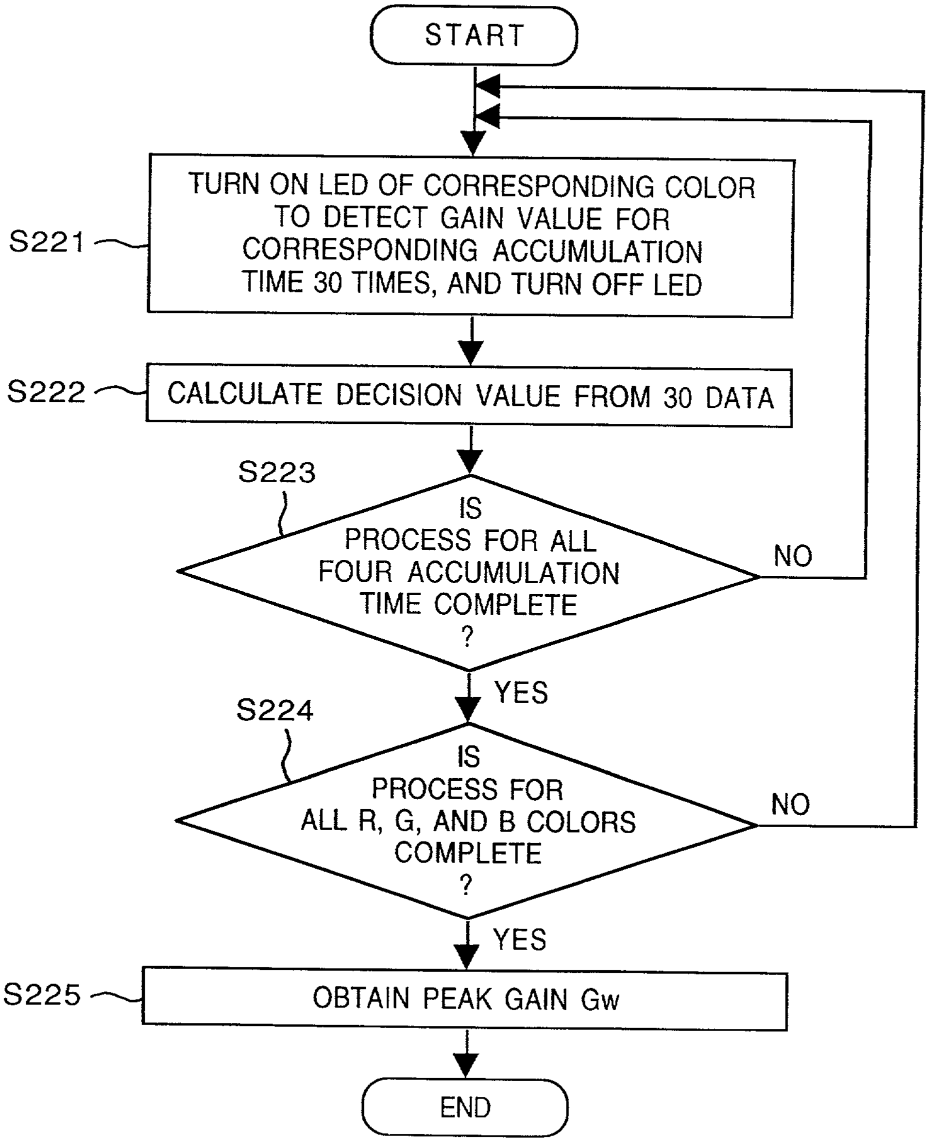

BDE0h
DUMMY SET
BDE4h
DUMMY SET
ACCUMULATION TIME SETTING
BDF8h
DUMMY SET
WHITE REFERENCE DATA DESIGNATION
BD00h
DATA SET
W1 SETTING OPERATION
BD7Fh
DATA SET
W128 SETTING OPERATION
BDF9h
DUMMY SET
OFFSET DESIGNATION
BD00h
DATA SET
W1 SETTING OPERATION
BD7Fh
DATA SET
W128 SETTING OPERATION
BDFAh
DUMMY SET
GAIN DESIGNATION
BD00h
DATA SET
W1 SETTING OPERATION
BDFBh
DUMMY SET
BD00h
DATA SET
BD80h
DATA SET
HEAD ID SETTING OPERATION
BD81h
DATA SET
TEMPERATURE SETTING OPERATION
BDF1h
DUMMY SET
BDF3h
DUMMY SET
COLOR DESIGNATION

FIG. 26


START
S201
MOVE CARRIAGE TO POSITION A
S202
PERFORM PEAK SEARCH TO OBTAIN GAIN
S203
DETECT OFFSET VALUE AND WHITE REFERENCE VALUE
S204
IRREGULAR WHITE DATA ?
YES
NO
S205
CORRECT EACH GAIN VALUE TO DETECT ALL OFFSET VALUES AND ALL WHITE REFERENCE VALUES AGAIN
S206
MOVE CARRIAGE TO POSITION B
S207
DETECT WHITE REFERENCE VALUE
S208
COMPARE WHITE REFERENCE VALUES AT POSITIONS A AND B FOR EACH COLOR, EACH ACCUMULATION TIME, AND EACH DOT AND DETERMINE LARGER ONES AS FINAL WHITE REFERENCE VALUES
S209
MOVE CARRIAGE TO HOME POSITION
S210
OBTAIN TEMPERATURE
S211
RESTORE HEAT-KEEPING STATE
END

F I G. 27


START
S221
TURN ON LED OF CORRESPONDING COLOR TO DETECT GAIN VALUE FOR CORRESPONDING ACCUMULATION TIME 30 TIMES, AND TURN OFF LED
S222
CALCULATE DECISION VALUE FROM 30 DATA
S223
IS PROCESS FOR ALL FOUR ACCUMULATION TIME COMPLETE ?
NO
YES
S224
IS PROCESS FOR ALL R, G, AND B COLORS COMPLETE ?
NO
YES
S225
OBTAIN PEAK GAIN Gw
END

F I G. 28

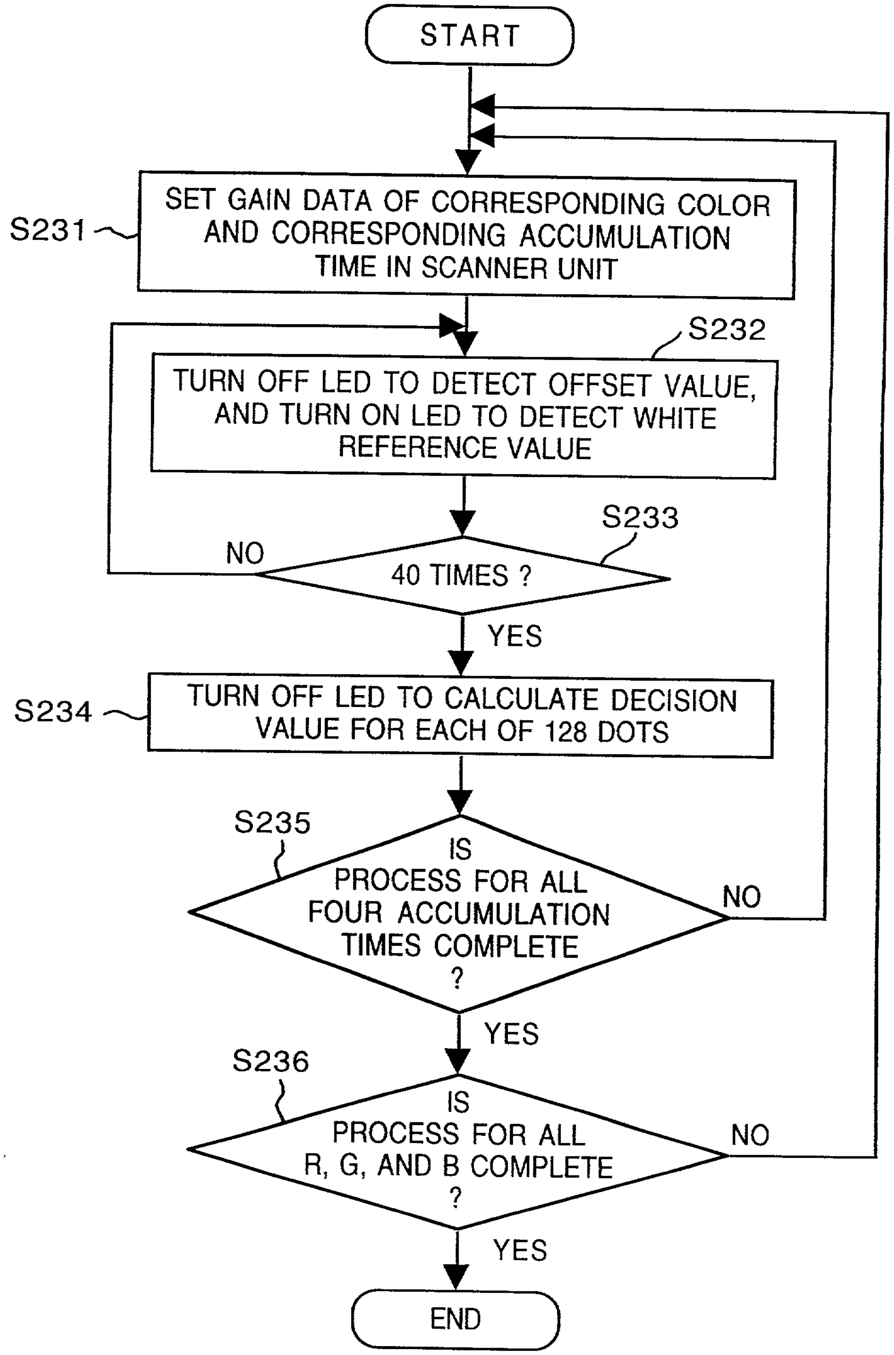
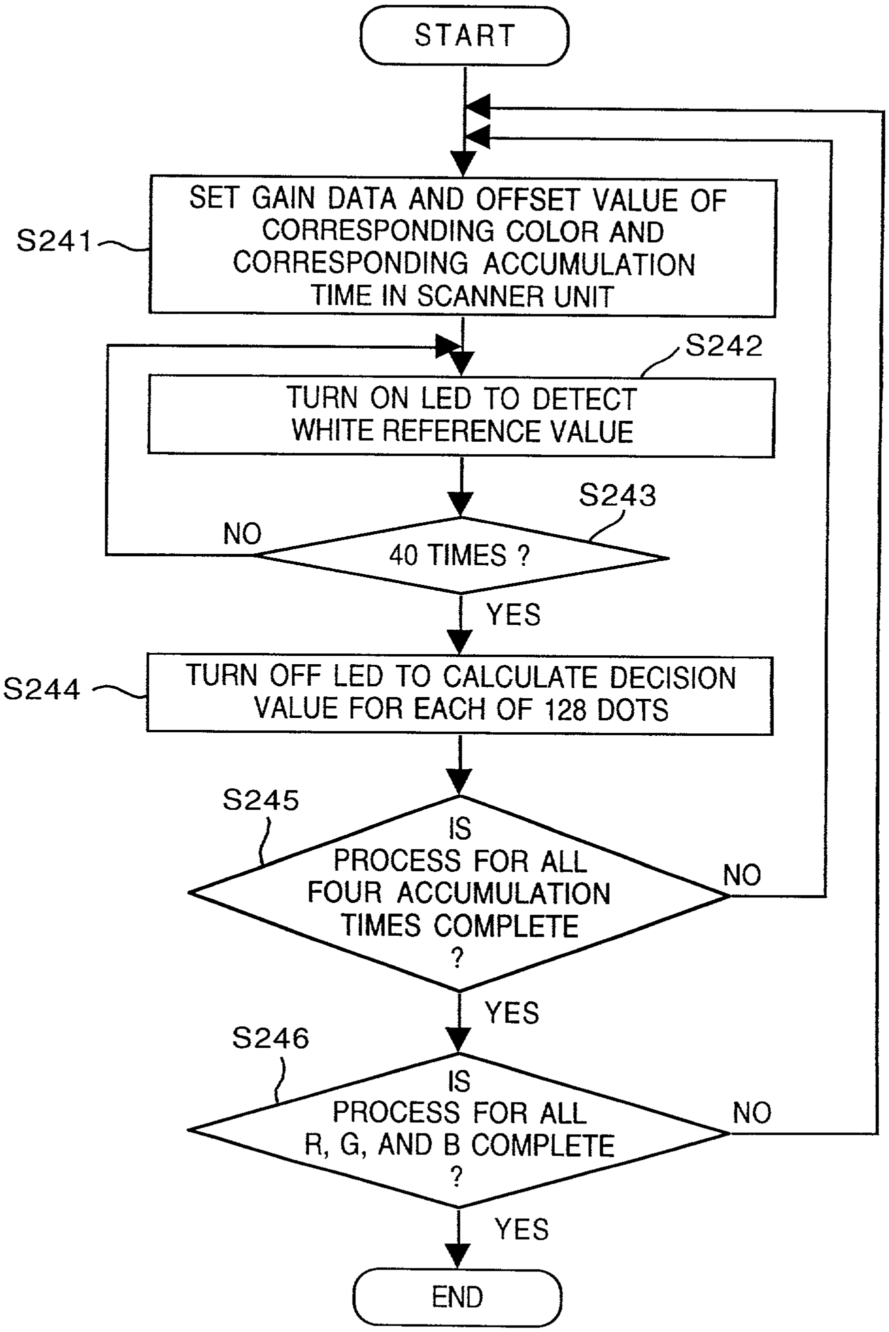

START
SET GAIN DATA OF CORRESPONDING COLOR AND CORRESPONDING ACCUMULATION TIME IN SCANNER UNIT
S231
S232
TURN OFF LED TO DETECT OFFSET VALUE, AND TURN ON LED TO DETECT WHITE REFERENCE VALUE
S233
40 TIMES ?
NO
YES
S234
TURN OFF LED TO CALCULATE DECISION VALUE FOR EACH OF 128 DOTS
S235
IS PROCESS FOR ALL FOUR ACCUMULATION TIMES COMPLETE ?
NO
YES
S236
IS PROCESS FOR ALL R, G, AND B COMPLETE ?
NO
YES
END

FIG. 29


START
SET GAIN DATA AND OFFSET VALUE OF CORRESPONDING COLOR AND CORRESPONDING ACCUMULATION TIME IN SCANNER UNIT
S241
TURN ON LED TO DETECT WHITE REFERENCE VALUE
S242
40 TIMES ?
S243
NO
YES
TURN OFF LED TO CALCULATE DECISION VALUE FOR EACH OF 128 DOTS
S244
IS PROCESS FOR ALL FOUR ACCUMULATION TIMES COMPLETE ?
S245
NO
YES
IS PROCESS FOR ALL R, G, AND B COMPLETE ?
S246
NO
YES
END

F I G. 30

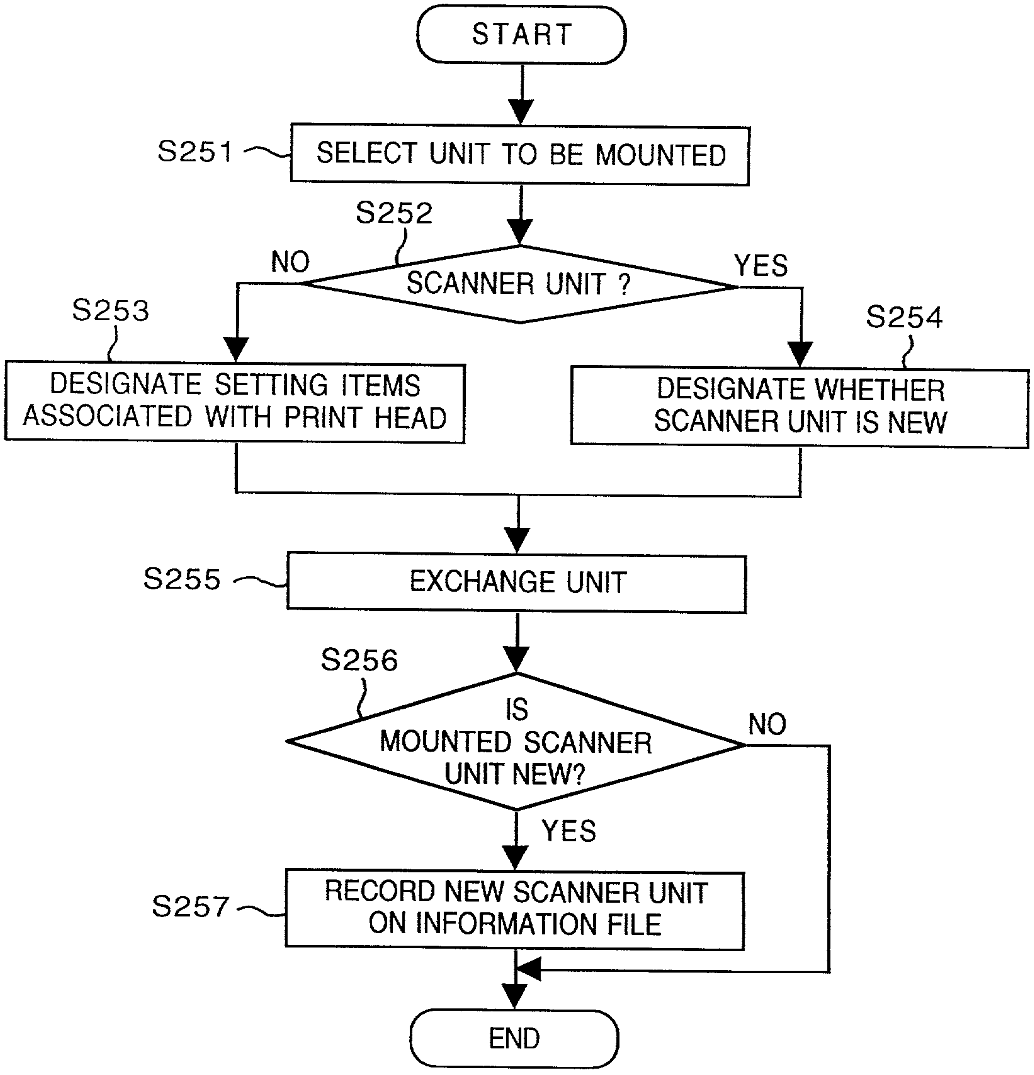
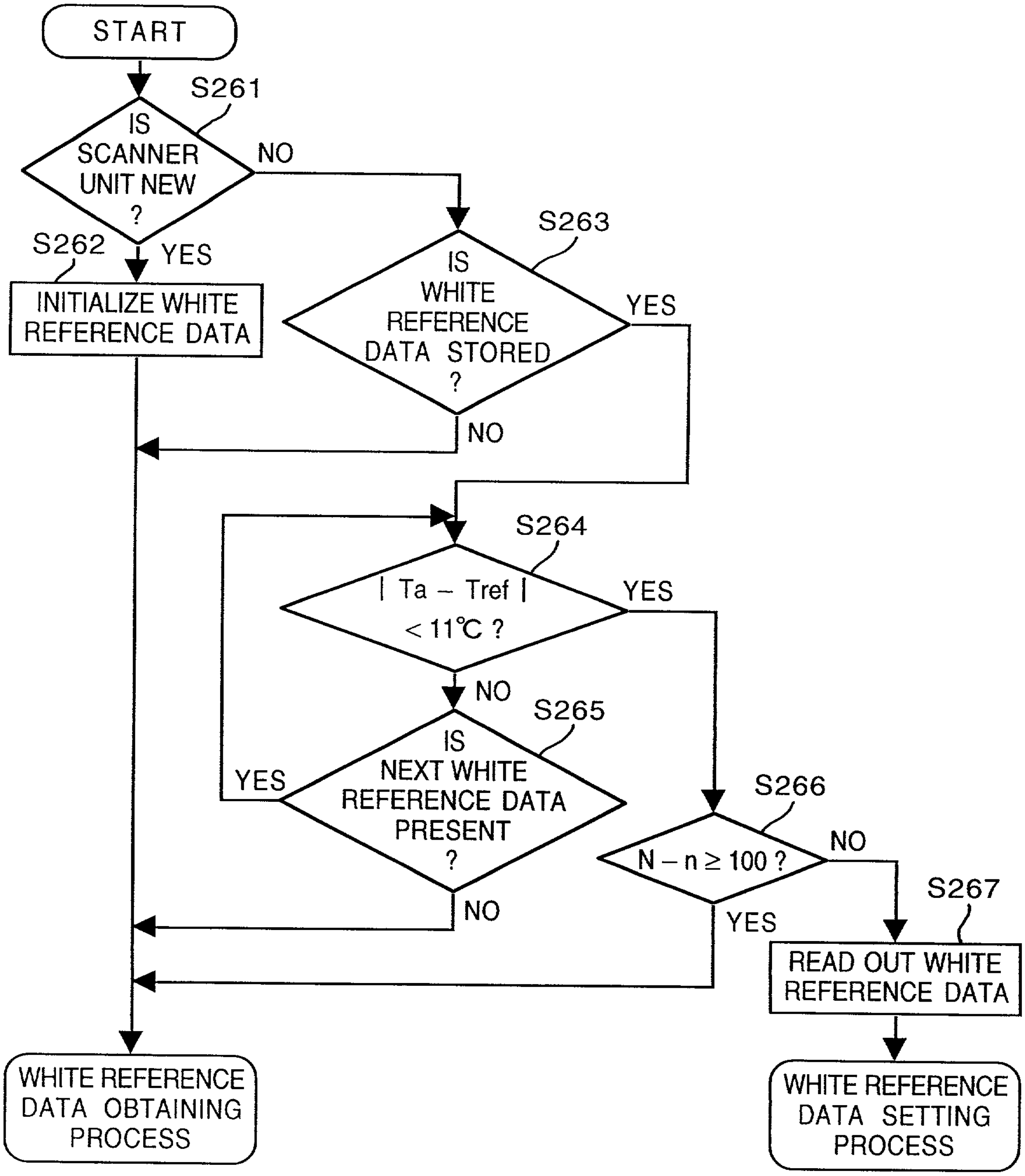

START
S251
SELECT UNIT TO BE MOUNTED
S252
SCANNER UNIT ?
NO
YES
S253
DESIGNATE SETTING ITEMS ASSOCIATED WITH PRINT HEAD
S254
DESIGNATE WHETHER SCANNER UNIT IS NEW
S255
EXCHANGE UNIT
S256
IS MOUNTED SCANNER UNIT NEW?
NO
YES
S257
RECORD NEW SCANNER UNIT ON INFORMATION FILE
END

FIG. 31


START
S261
IS SCANNER UNIT NEW ?
NO
YES
S262
INITIALIZE WHITE REFERENCE DATA
S263
IS WHITE REFERENCE DATA STORED ?
YES
NO
S264
| Ta − Tref | < 11℃ ?
YES
NO
S265
IS NEXT WHITE REFERENCE DATA PRESENT ?
YES
NO
S266
N − n ≥ 100 ?
NO
YES
S267
READ OUT WHITE REFERENCE DATA
WHITE REFERENCE DATA OBTAINING PROCESS
WHITE REFERENCE DATA SETTING PROCESS

F I G. 32

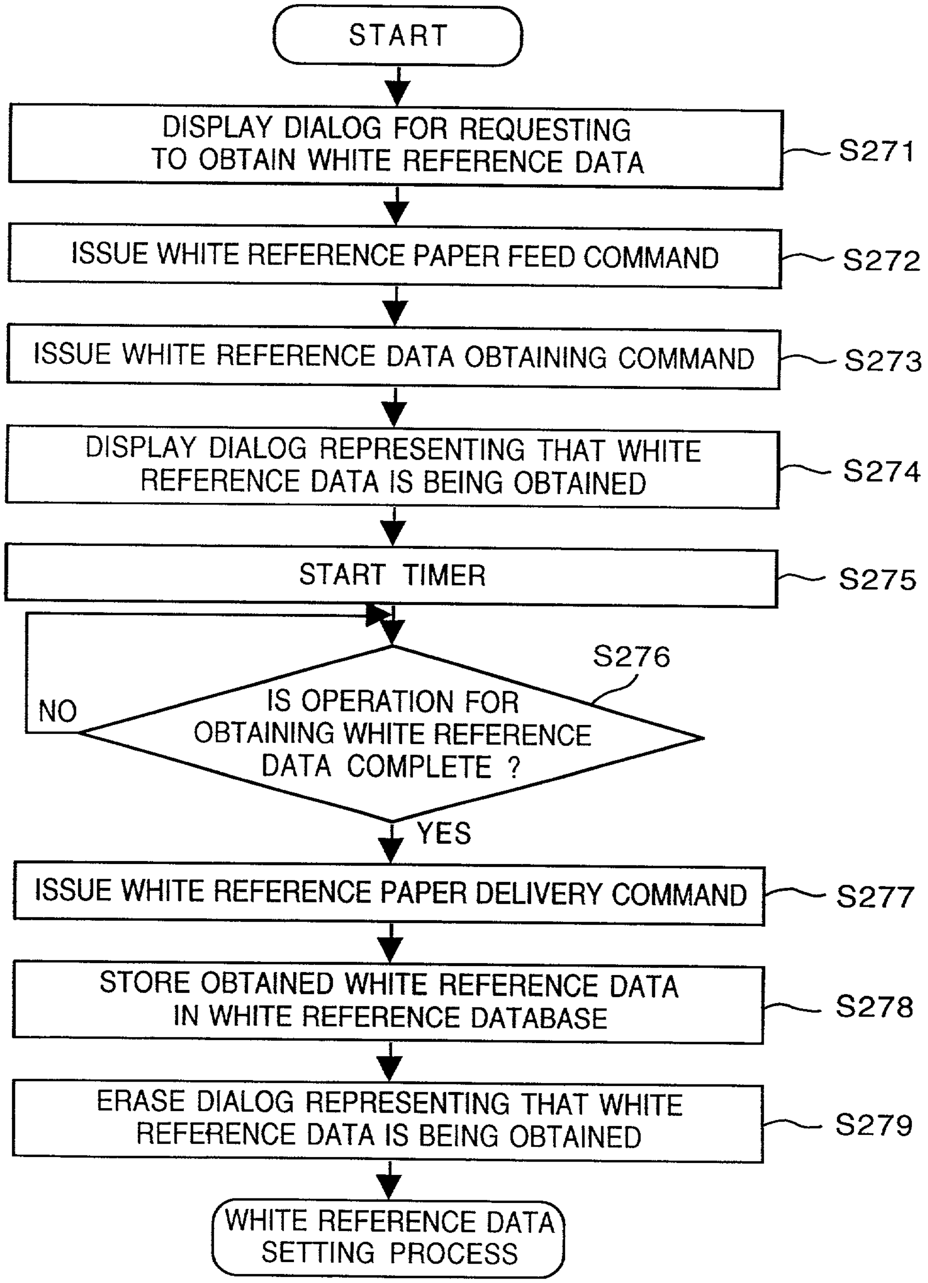
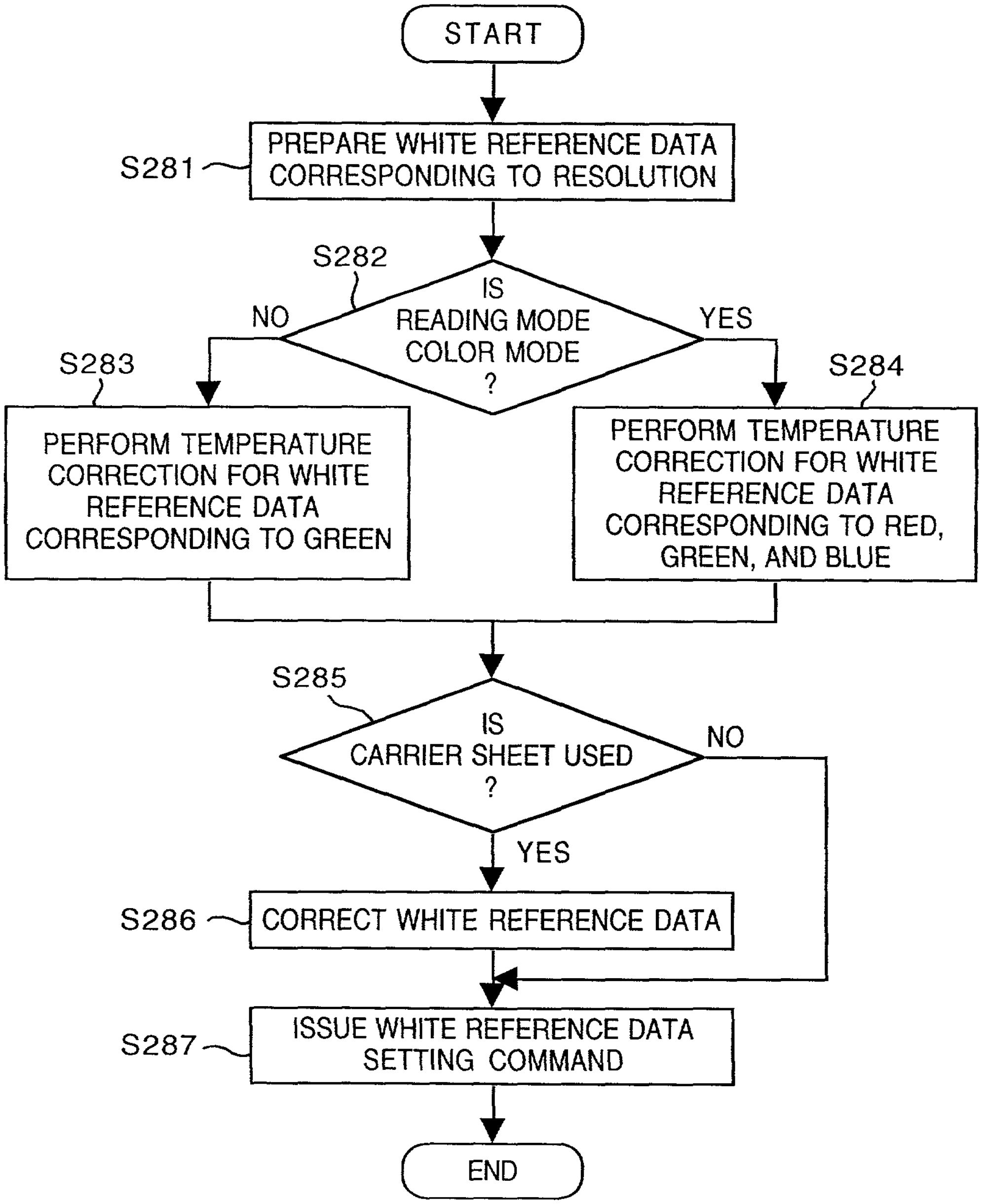

START
DISPLAY DIALOG FOR REQUESTING TO OBTAIN WHITE REFERENCE DATA
S271
ISSUE WHITE REFERENCE PAPER FEED COMMAND
S272
ISSUE WHITE REFERENCE DATA OBTAINING COMMAND
S273
DISPLAY DIALOG REPRESENTING THAT WHITE REFERENCE DATA IS BEING OBTAINED
S274
START TIMER
S275
S276
IS OPERATION FOR OBTAINING WHITE REFERENCE DATA COMPLETE ?
NO
YES
ISSUE WHITE REFERENCE PAPER DELIVERY COMMAND
S277
STORE OBTAINED WHITE REFERENCE DATA IN WHITE REFERENCE DATABASE
S278
ERASE DIALOG REPRESENTING THAT WHITE REFERENCE DATA IS BEING OBTAINED
S279
WHITE REFERENCE DATA SETTING PROCESS

FIG. 33


START
S281
PREPARE WHITE REFERENCE DATA CORRESPONDING TO RESOLUTION
S282
IS READING MODE COLOR MODE ?
NO
YES
S283
PERFORM TEMPERATURE CORRECTION FOR WHITE REFERENCE DATA CORRESPONDING TO GREEN
S284
PERFORM TEMPERATURE CORRECTION FOR WHITE REFERENCE DATA CORRESPONDING TO RED, GREEN, AND BLUE
S285
IS CARRIER SHEET USED ?
NO
YES
S286
CORRECT WHITE REFERENCE DATA
S287
ISSUE WHITE REFERENCE DATA SETTING COMMAND
END